THE

LAWRENCE SCIENTIFIC SCHOOL

April 1899

ANNOUNCEMENT

OF THE

LAWRENCE SCIENTIFIC SCHOOL

OF

HARVARD UNIVERSITY

APRIL 1899

1898.

JULY.

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CONTENTS.

SCIENTIFIC SCHOOL CALENDAR.

1898.

Sept. 28, Wednesday. Registration of students.

Sept. 29, Thursday. **Academic Year begins.** Registration of students continued.

Nov. 24, Thursday. Thanksgiving Day: a holiday.

RECESS FROM DEC. 23, 1898, TO JAN. 2, 1899, INCLUSIVE.

1899.

Feb. 13, Monday. **Second half-year begins.**

Feb. 22, Wednesday. Washington's Birthday: a holiday.

March 1, Wednesday. Last day for receiving applications of candidates for Final Honors in Geology in 1900.

March 31, Friday. Last day for re-engaging College Rooms for 1899–1900.

RECESS FROM APRIL 16 TO APRIL 22, INCLUSIVE.

May 1, Monday. Last day for receiving theses of candidates for the degree of S.D.

May 1, Monday. Last day for receiving dissertations for the Dante, Toppan, and Sumner Prizes.

May 1, Monday. Notice of intention to compete for the Sales Prize must be given on or before this date.

May 1, Monday. Last day for receiving application for College Rooms for 1899–1900.

May 4, Thursday. Assignment of College Rooms for 1899–1900.

May 30, Tuesday. Memorial Day: a holiday.

June 1, Thursday. Last day for receiving applications for Scholarships for 1899–1900.

June 23, Friday. Seniors' Class Day.

June 27–July 1, Tuesday to Saturday. **Examinations for admission to the School.**

June 28, Wednesday. **Commencement.**

SUMMER VACATION OF THIRTEEN WEEKS, FROM COMMENCEMENT DAY TO SEPTEMBER 27, INCLUSIVE.

July 5, Wednesday. Summer School opens.

Sept. 20–23, Wednesday to Saturday. Examinations for admission to the School.

Sept. 27, Wednesday. Registration of students.

Sept. 28, Thursday. **Academic Year begins.** Registration of students continued.

Oct. 31, Tuesday. Last day for receiving applications of candidates for Final Honors (except in Geology) in 1900.

Nov. 23, Thursday. Thanksgiving day: a holiday.

DEPARTMENTS OF HARVARD UNIVERSITY.

The University comprehends the following departments: —

HARVARD COLLEGE,
THE LAWRENCE SCIENTIFIC SCHOOL,
THE GRADUATE SCHOOL,
THE DIVINITY SCHOOL,
THE LAW SCHOOL,
THE MEDICAL SCHOOL,
THE DENTAL SCHOOL,
THE SCHOOL OF VETERINARY MEDICINE,
THE BUSSEY INSTITUTION (a School of Agriculture),
THE ARNOLD ARBORETUM,
THE UNIVERSITY LIBRARY,
THE MUSEUM OF COMPARATIVE ZOÖLOGY,
THE PEABODY MUSEUM OF AMERICAN ARCHAEOLOGY AND ETHNOLOGY.
THE UNIVERSITY MUSEUM,
THE BOTANIC GARDEN,
THE GRAY HERBARIUM,
THE ASTRONOMICAL OBSERVATORY.

☞ **Students in regular standing in any one department of the University are admitted free to the instruction and the examinations given in any other department, with the exception of exercises carried on in the special laboratories. (This rule does not apply to Special nor to Graduate Students unless they pay the full fee of $150 a year.)**

ADMINISTRATIVE OFFICERS.

THE UNIVERSITY.

President: CHARLES WILLIAM ELIOT, LL.D.
Office, 5 University Hall, Cambridge.

Treasurer: CHARLES FRANCIS ADAMS, 2d, A.B., LL.B.

Comptroller: ALLEN DANFORTH, A.M.
The office of the Corporation (and of the Treasurer and the Comptroller) is at 50 State Street, Boston. Office hours, 10 A.M. to 2 P.M., Saturday 10 A.M. to 12 M.

Bursar: CHARLES FRANK MASON, A.B.
Office, Wadsworth House, Cambridge. Office hours, 9 A.M. to 1 P.M.

Librarian: WILLIAM COOLIDGE LANE, A.B.
Office, Gore Hall, Cambridge.

Director of Hemenway Gymnasium: DUDLEY ALLEN SARGENT, M.D., S.D.
Office, Hemenway Gymnasium, Cambridge.

Regent: GEORGE ALONZO BARTLETT, A.M.
Office, 5 University Hall, Cambridge.

Corresponding Secretary: RICHARD COBB, A.B.
Office, 5 University Hall, Cambridge. Office hours, daily, 9 A.M. to 10 A.M.

Publication Agent: JOHN BERTRAM WILLIAMS, A.B.
Office, 2 University Hall, Cambridge. Office hours, 9 A.M. to 5 P.M., Saturday 9 A.M. to 12.30 P.M.

THE FACULTY OF ARTS AND SCIENCES.

The Offices of this Faculty and of the Departments under its charge at Nos. 4, 5, 10, and 16, University Hall, Cambridge, are open on weekdays, except Saturdays from 9 A.M. *to* 1 P.M., *and on Saturdays from* 9 A.M. *to* 12 M. *Nos. 5, 10, and 16 are also ordinarily open on weekdays except Saturdays, from* 2 *to* 4 P.M.

Dean of the Faculty of Arts and Sciences: CLEMENT LAWRENCE SMITH, A.M., LL.D.
Office, 5 University Hall.

Dean of the Graduate School: JOHN HENRY WRIGHT, A.M.
Office, 10 University Hall. Office hours, Monday, Thursday, 3.30 P.M. to 4.30 P.M.

Dean of Harvard College: LE BARON RUSSELL BRIGGS, A.M.
Office, 4 University Hall. Office hours, Monday, Tuesday, Friday, 10 A.M. to 12.30 P.M.

Dean of the Lawrence Scientific School: NATHANIEL SOUTHGATE SHALER, S.D.
Office, 16 University Hall. Office hours, daily, 9 A.M., except Saturday.

Recording Secretary and Secretary of Appointment Committee: BYRON SATTERLEE HURLBUT, A.M.
Office, 5 University Hall. Office hours, daily, 9 A.M. to 10 A.M. Monday, Tuesday, Friday, Saturday, 9 A.M. to 12 M.

Chairman of the Committee on Special Students: HUGO KARL SCHILLING, PH.D.
Office, 4 University Hall. Office hour, daily, 12–12.30 P.M.

Chairman of the Committee on Admission from other Colleges: ARTHUR RICHMOND MARSH, A.B.
Office, 10 University Hall. Office hours, Tuesday, 12.15 P.M., Thursday 2 P.M.

Recorder of the Faculty of Arts and Sciences: GEORGE WASHINGTON CRAM, A.B.
Office, 4 University Hall. Office hours, 9 A.M. to 1 P.M. Saturday 9 A.M. to 12 M.

Secretary of the Lawrence Scientific School and Clerk of the Summer School: MONTAGUE CHAMBERLAIN.
Office, 16 University Hall. Office hours, 9 A.M. to 4 P.M.; Saturday, 9 A.M. to 12 M.

LABORATORIES AND MUSEUMS ASSOCIATED WITH THE FACULTY OF ARTS AND SCIENCES.

Director of the Chemical Laboratory: HENRY BARKER HILL, A.M.
The Chemical Laboratory is in Boylston Hall.

Director of the Jefferson Physical Laboratory: JOHN TROWBRIDGE, S.D.
The Jefferson Physical Laboratory is on Holmes Field.

Director of the Psychological Laboratory: HUGO MÜNSTERBERG, PH.D., M.D.
The Psychological Laboratory is in Dane Hall.

In charge of the Museum of Comparative Zoölogy: WILLIAM MCMICHAEL WOODWORTH, PH.D.

In charge of the Botanical Museum: GEORGE LINCOLN GOODALE, M.D., LL.D.

The Botanical Laboratories are in the same building.

Curator of the Mineralogical Museum: JOHN ELIOT WOLFF, PH.D.

Curator of the Peabody Museum of Archaeology and Ethnology: FREDERIC WARD PUTNAM, A.M., S.D.

Curator of the Semitic Museum: DAVID GORDON LYON, PH.D.

The above Museums are between Oxford Street and Divinity Avenue.

Director of the William Hayes Fogg Museum of Art and Curator of the Gray Collection of Engravings: CHARLES HERBERT MOORE, A.M.

The Fogg Museum of Art is on Cambridge Street.

Director of the Botanic Garden: GEORGE LINCOLN GOODALE, M.D., LL.D.

Curator of the Gray Herbarium: BENJAMIN LINCOLN ROBINSON, PH.D.

The Herbarium and Botanic Garden are at the corner of Garden and Linnaean Streets.

OTHER FACULTIES AND DEPARTMENTS.

Dean of the Faculty of Divinity: CHARLES CARROLL EVERETT, D.D., LL.D., Office, 1 Divinity Library, Cambridge. Office hours Monday, Wednesday, Friday, 12 M., Tuesday, Thursday, Saturday, 10 A.M.

Secretary of the Faculty of Divinity, and *Librarian of the Divinity School:* ROBERT SWAIN MORISON, A.M., S.T.B.

Office, Divinity Library, Cambridge. Office hours, daily, 9 A.M. to 1 P.M.

Dean of the Faculty of Law: JAMES BARR AMES, A.M., LL.B.

Office, Austin Hall, Cambridge.

Secretary of the Faculty of Law: EUGENE ALLEN GILMORE, A.B.

Office, Austin Hall, Cambridge.

Librarian of the Law School: JOHN HIMES ARNOLD.

Office, Austin Hall, Cambridge.

Dean of the Faculty of Medicine: WILLIAM LAMBERT RICHARDSON, A.M., M.D.

Office, Harvard Medical School, corner of Boylston and Exeter Streets, Boston. Office hours, Tuesday, Friday, 12.15 P.M. to 1 P.M.

Secretary of the Faculty of Medicine: CHARLES MONTRAVILLE GREEN, M.D.

Office, Harvard Medical School, corner of Boylston and Exeter Streets, Boston. Office hours, Monday, Thursday, 12 M. to 1 P.M.

Dean of the Faculty of Dental Medicine: EUGENE HANES SMITH, D.M.D.
The Dental School is on North Grove Street, Boston. The office of the Dean is at 283 Dartmouth Street, Boston. Office hours, 9 A.M. to 4 P.M.

Curator of the Dental Museum: WALDO ELIAS BOARDMAN, D.M.D.
Office, 184 Boylston Street, Boston.

Dean of the Faculty of Veterinary Medicine: CHARLES PARKER LYMAN, F.R.C.V.S.
Office, 52 Village Street, Boston. Office hours, 10 A.M. to 12 M. Daily.

Surgeon in charge of Veterinary Hospital: FREDERICK HUNTINGTON OSGOOD, M.R.C.V.S.
The Hospital is at 50 Village Street, Boston. Office hour, 12 M. Daily.

Dean of the Bussey Institution: FRANCIS HUMPHREYS STORER, S.B., A.M.
The Bussey Institution is in Jamaica Plain. The nearest railway and telegraph station is Forest Hills, on the Boston and Providence Division of the N. Y., N. H., and Hartford Railroad.

Superintendent of the Bussey Farm: EDMUND HERSEY.
The post-office address of the Farm Superintendent is Roslindale.

Director of the Arnold Arboretum: CHARLES SPRAGUE SARGENT, A.B.
The Arnold Arboretum is in Jamaica Plain. The nearest railway and telegraph station is Forest Hills, on the Boston and Providence Division of the N. Y., N. H. & Hartford Railroad.

Director of the Astronomical Observatory: EDWARD CHARLES PICKERING, LL.D.
The Observatory is at the corner of Garden and Bond Streets, Cambridge.

ABBREVIATIONS.

C.	College House.	H'ke	Holyoke House.
C't	Conant Hall.	H'y	Holworthy Hall.
D.	Divinity Hall.	M.	Matthews Hall.
D. H.	Divinity House.	P.	Perkins Hall.
F.	Foxcroft House.	S.	Stoughton Hall.
G.	Grays Hall.	T.	Thayer Hall.
Gnt.	Gannett House.	W.	Weld Hall.
H.	Hollis Hall.	W. H.	Walter Hastings Hall.

THE PRESIDENT AND FELLOWS OF HARVARD COLLEGE.

This Board is commonly known as the CORPORATION.

PRESIDENT.

CHARLES WILLIAM ELIOT, LL.D.,
17 Quincy St., Cambridge.

FELLOWS.

HENRY PICKERING WALCOTT, A.B., M.D.,
11 Waterhouse St., Cambridge.

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SAMUEL HOAR, A.B., Concord.

FRANCIS CABOT LOWELL, A.B.,
709 Exchange Building, Boston.

ARTHUR TRACY CABOT, A.M., M.D.,
3 Marlborough St., Boston.

TREASURER.

CHARLES FRANCIS ADAMS, 2d, A.B., LL.B.,
23 Court St., Boston.

THE BOARD OF OVERSEERS.

The PRESIDENT and TREASURER of the University, *ex officio*, and the following persons by election: —

1899.*

MOSES WILLIAMS, A.B., 18 Post Office Square, Boston.

ROBERT McNEIL MORSE, A.B., 57 Equitable Building, Boston.

ARTHUR THEODORE LYMAN, A.M., 39 Beacon St., Boston.

WILLIAM AMOS BANCROFT, A.B., 5 Putnam Ave., Cambridge.

ROBERT SWAIN PEABODY, A.M., 919 Exchange Building, Boston.

1900.

AUGUSTUS HEMENWAY, A.B., 10 Tremont St., Boston.

CHARLES COTESWORTH BEAMAN, A.M., 52 Wall St., New York, N. Y.

SAMUEL ABBOTT GREEN, M.D., LL.D., 317 Tremont Building, Boston.

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GEORGE FRISBIE HOAR, LL.B., LL.D., Worcester.

1901.

THEODORE ROOSEVELT, A.B., Oyster Bay, Long Island, N. Y.

CHARLES FRANCIS ADAMS, A.B., LL.D., 23 Court St., Boston.

EDMUND WETMORE, A.B., LL.B., 34 Pine St., New York, N. Y.

ROBERT BACON, A.B., 23 Wall St., New York, N. Y.

ROBERT GRANT, PH.D., LL.B., 205 Bay State Road, Boston.

* The term expires, in each case, on Commencement Day of the year indicated.

1902.

SOLOMON LINCOLN, A.M., LL.B., *President*, 191 Commonwealth Ave., Boston.

DAVID WILLIAMS CHEEVER, M.D., LL.D., 557 Boylston St., Boston.

GEORGE BRUNE SHATTUCK, A.M., M.D., 183 Beacon St., Boston.

FRANCIS RAWLE, A.M., LL.B., 328 Chestnut St., Philadelphia, Pa.

EDWIN PLINY SEAVER, A.M., LL.B., Waban.

1903.

CHARLES JOSEPH BONAPARTE, A.B., LL.B., 216 St. Paul St., Baltimore, Md.

CHARLES FOLLEN FOLSOM, A.M., M.D., 15 Marlborough St., Boston.

JAMES JACKSON STORROW, A.B., LL.B., 40 Water St., Boston.

FRANCIS LEE HIGGINSON, A.B., 50 State St., Boston.

GEORGE ANGIER GORDON, A.B., D.D., 645 Boylston St., Boston.

1904.

MOORFIELD STOREY, A.M., 735 Exchange Building, Boston.

JOHN NOBLE, A.B., LL.B., Court House, Pemberton Sq., Boston.

WINSLOW WARREN, A.B., LL.B., Dedham.

HENRY SHIPPEN HUIDEKOPER, A.M., P. O. Box 533, Philadelphia, Pa.

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ALEXANDER McKENZIE, A.M., D.D., 12 Garden St., Cambridge.

FACULTY OF ARTS AND SCIENCES.

FACULTY.

[*FOR THE ACADEMIC YEAR 1898-99.*]

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ALBERT A. HOWARD, PH.D., *Assistant Professor of Latin.*
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Biddle, Nicholas,	2	Gen. Sci.	*Cambridge.*
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House, Herbert Bissell,	1	Civ. Engin.	*So. Manchester, Conn.*
Howe, Reginald Heber,	*S.*	Biology.	*Longwood.*
Hoyt, Giles Milton,	2	Elec. Engin.	*Danbury, Conn.*
Hubbard, Robert Frederick,	*S.*	Civ. Engin.	*Cazenovia, N. Y.*
Hughes, Hector James, A.B. 1894,	4	Civ. Engin.	*Brookline.*
Hughes, Harold Lincoln,	3	Mech. Engin.	*Saugus.*
Humphrey, Campbell,	2	Gen. Sci.	*Brookline.*
Humphrey, George Richardson,	*S.*	Chem.	*Cambridge.*
Huntress, George Lewis,	1	Arch.	*Winchester.*
Hurley, John Christopher,	1	Gen. Sci.	*Charlestown.*
Iselin, Arthur,	1	Gen. Sci.	*New Rochelle, N. Y.*
Jaffray, Percy Malcolm,	4	Gen. Sci.	*Irvington-on-Hudson, N. Y.*

Jamieson, William Daniels,	*S.*	Gen. Sci.	*Chicago, Ill.*
Janney, Laurence Aquila,	1	Elec. Engin.	*Washington, D.C.*
Jaynes, Charles William,	2	Gen. Sci.	*Boston.*
Jett, Chan Moon,	*S.*	Elec. Engin.	*China.*
Johnson, Charles Leslie, S.B. (*Oregon Agri. Coll.*) 1897,	*S.*	Civ. Engin.	*Corvallis, Ore.*
Johnson, Richard Croswell,	*S.*	Mech. Engin.	*Cambridge.*
Johnson, Roswell Hill,	3	Biology.	*Buffalo, N. Y.*
Jones, Frank Lorimer,	1	Civ. Engin.	*Sandwich.*
Jones, Frederic Marshall, A.B. 1896,	3	Arch.	*Somerville.*
Joyce, Louis Valentine,	2	Mech. Engin.	*Somerville.*
Kasson, Burt Zelotes,	*S.*	Mining.	*Gloversville, N. Y.*
Keller, Ralph Henshaw,	1	Civ. Engin.	*Newton.*
Kent, Gilbert Ray,	1	Civ. Engin.	*Wollaston.*
Kimball, Arthur Clark,	2	Civ. Engin.	*Lynn.*
Kimball, George Cook,	3	Elec. Engin.	*Boston.*
Kimbrough, James Lloyd,	*S.*	Gen. Sci.	*Muncie, Ind.*
King, Frank Shapley,	*S.*	Gen. Sci.	*Somerville.*
Kirmayer, Frank Henry,	3	Sci. T.	*Bridgewater.*
Klein, Samuel Mark,	1	Civ. Engin.	*Greenfield.*
Knight, Edward Carleton,	1	Sci. T.	*Manchester.*
Knight, William Horatio,	*S.*	Chem.	*Hopedale.*
Knowles, Lucius James,	1	Gen. Sci.	*Worcester.*
Ladd, Charles Haven,	3	Gen. Sci.	*Galveston, Tex.*
Lathrop, Fred Haskins,	2	Civ. Engin.	*Charlestown.*
Leatherbee, Clifton Felton,	*S.*	Mech. Engin.	*W. Newton.*
Lee, Edward Brown,	2	Arch.	*Island Pond, Vt.*
Leighton, Charles Edward,	1	Arch.	*Roxbury.*
Lewin, Frank Spalding,	*S.*	Hyg.	*Brooklyn, N. Y.*
Lewis, John Henry,	*S.*	Gen. Sci.	*Boston.*
Lincoln, Alfred Reynolds,	1	Chem.	*Cambridge.*
Lindsley, Frederic Cleland,	1	Civ. Engin.	*Washington, D.C.*
Lissner, Emanuel,	2	Mining.	*Boston.*
Locke, Henry Weideman,	1	Elec. Engin.	*Cambridge.*
Locke, James Pillsbury,	3	Civ. Engin.	*Waltham.*
Lockwood, Cornelius Wygant,	4	Sci. T.	*Newburgh, N. Y.*
Low, Josiah Orne,	1	Elec. Engin.	*Brooklyn, N. Y.*
Luscomb, Henry Martin,	2	Mech. Engin.	*Bridgeport, Conn.*
Lynch, Henry Hawley,	1	Mech. Engin.	*Boston.*
McCaffrey, Charles Francis,	4	Chem.	*Somerville.*
McCornick, Lewis Bell,	*S.*	Gen. Sci.	*Salt Lake City, Utah.*
McDonald, Louis Ronald,	*S.*	Hyg.	*Charlestown.*

MacDonald, Wm. Henry Vincent,	*S.*	Arch.	*Fall River.*
McElligott, James John Thomas,	2	Civ. Engin.	*Charlestown.*
MacFarland, Jay,	*S.*	Hyg.	*Cambridge.*
McGrath, William Henry,	2	Elec. Engin.	*Quincy.*
McLaughlin, Frederick Leo,	1	Gen. Sci.	*Chicago, Ill.*
McLean, Guy Barker,	1	Chem.	*Cambridge.*
McLean, George Samuel Read,	2	Arch.	*Cambridge.*
McNary, Charles Herbert,	3	Elec. Engin.	*Brooklyn, N. Y.*
McNeil, Howard Crichton,	1	Gen. Sci.	*Elgin, Ill.*
Marshall, John Francis,	3	Mech. Engin.	*Cambridge.*
Martin, Kenneth McGeoch,	2	Gen. Sci.	*Milwaukee, Wis.*
Mason, Albert Gardner,	3	Gen. Sci.	*Worcester.*
Mayhew, Osgood Norton,	2	Gen. Sci.	*No. Tisbury.*
Meadowcroft, William,	2	Civ. Engin.	*Cambridge.*
Michelson, Albert,	2	Mech. Engin.	*New Rochelle, N. Y.*
Millard, Jean Sears,	2	Hyg.	*Boston.*
Mills, Edwin Walter,	2	Mining.	*Roxbury.*
Mills, Nathaniel Child,	*S.*	Civ. Engin.	*Malden.*
Mills, Samuel Frederic,	2	Geol.	*Fort Monroe, Va.*
Moeller, Edward Heine,	1	Arch.	*Buffalo, N. Y.*
Moline, Charles,	2	Hyg.	*Sunderland.*
Moore, Henry Bailey,	3	Elec. Engin.	*Yonkers, N. Y.*
Moore, Philip Hooper,	1	Mech. Engin.	*Newtonville.*
Moore, Ralph Spencer,	3	Gen. Sci.	*Cambridge.*
Moore, William Addison,	3	Elec. Engin.	*Toronto, Can.*
Morgan, Charles Francis,	2	Gen. Sci.	*Worcester.*
Morrill, Charles Henry,	3	Elec. Engin.	*St. Louis, Mo.*
Morse, Arthur Holmes,	2	Mech. Engin.	*Oxford, Me.*
Mortland, Walter Guy,	*S.*	Gen. Sci.	*Allegheny City, Pa.*
Moses, Edmund Quincy,	1	Mech. Engin.	*Waltham.*
Moses, Herbert Wallis,	3	Elec. Engin.	*Chelsea.*
Mowll, William Luther,	4	Arch.	*Cambridge.*
Moyer, James Ambrose,	4	Elec Engin.	*Norristown, Pa.*
Moynahan, Thomas Vincent,	2	Chem.	*Cambridge.*
Muzzey, Herbert Sprague,	*S.*	Arch.	*Cambridge.*
Nash, Howard Patterson,	3	Gen. Sci.	*Ridgefield, Conn.*
Nason, Robert Bray,	2	Mining.	*Brownville, Me.*
Neal, George Franklin,	2	Mining.	*Brockton.*
Newlin, William Bleecker,	1	Mech. Engin.	*Fishkill-on-Hudson, N. Y.*
Nichols, Melville Terry,	1	Civ. Engin.	*Haverhill.* [*N. Y.*
Niles, Irving Harris,	1	Hyg.	*Cambridge.*
Norton, Clifford,	3	Civ. Engin.	*Everett.*
Noyes, Gordon August,	*S.*	Gen. Sci.	*Boston.*

Nute, Albert James,	4	Hyg.	*Winthrop.*
Otis, Wilbur Corthill,	1	Mech. Engin.	*Cambridge.*
Page, John Hickok,	3	Mech. Engin.	*Rutland, Vt.*
Paige, John Edwards,	1	Mech. Engin.	*Southbridge.*
Parker, Gurdon Saltonstall,	2	Arch.	*Cambridge.*
Parker, Lewis Clifford,	1	Chem.	*Lunenburg, N.S.*
Parker, William Stanley,	3	Arch.	*Brookline.*
Pearce, Arthur Cushing,	1	Hyg.	*Somerville.*
Peirce, Royal Kellum,	1	Mech. Engin.	*Somerville.*
Perham, David,	2	Arch.	*Chelmsford.*
Perkins, Harry Forrester,	1	Civ. Engin.	*Cambridge.*
Pettit, Townsend Baldwin,	1	Gen Sci.	*Hempstead, L.I.*
Pew, Harry Gerard,	1	Gen. Sci.	*Gloucester.*
Peyton, Hamilton Howe,	2	Elec. Engin.	*Duluth, Minn.*
Phelps, Gouverneur Morris,	1	Gen. Sci.	*New Rochelle, N. Y.*
Phillips, John Charles,	4	Biology.	*Boston.*
Pierce, Edward Abbè,	1	Hyg.	*New Bedford.*
Pierce, Hugh Clay,	3	Elec. Engin.	*Buffalo, N. Y.*
Piper, Harry Lyman,	*S.*	Biology.	*Fitchburg.*
Pollak, Robert Raphael,	1	Civ. Engin.	*Montgomery, Ala.*
Pope, Frederick,	*S.*	Elec. Engin.	*Cambridge.*
Pope, Niran Bates,	*S.*	Mech. Engin.	*Cambridge.*
Porter, Augustus Granger,	2	Civ. Engin.	*Niagara Falls, N. Y.*
Pownall, William Arthur,	1	Mech. Engin.	*Waltham.*
Presby, George Watson,	3	Mech. Engin.	*Malden.*
Proctor, Thomas Emerson, A.B. 1895,	*S.*	Arch.	*Boston.*
Provandie, Paul Hector, M.D. 1898,	2	Hyg.	*Melrose Highlands.*
Pruyn, Robert Dunbar,	1	Gen. Sci.	*Albany, N. Y.*
Pultz, John Leggett,	1	Geol.	*New York, N. Y.*
Purington, Frank Howard,	4	Arch.	*Boston.*
Reardon, Daniel Bartholomew,	*S.*	Hyg.	*Quincy.*
Reed, Carlisle,	1	Chem.	*Boston.*
Reed, Frank Nutting,	1	Mech. Engin.	*Cambridge.*
Reilly, William Griffin,	1	Civ. Engin.	*Watertown.*
Rice, Arthur Waldo,	2	Geol.	*Boston.*
Richards, Francis Gragg,	1	Mining.	*Dedham.*
Richards, John Bradford,	3	Mech. Engin.	*Andover.*
Richards, Oliver Filley,	3	Gen. Sci.	*St. Louis, Mo.*
Ristine, Albert Wells,	*S.*	Mining.	*Fort Dodge, Ia.*
Robinson, Charles Bonnycastle,	1	Arch.	*Anchorage, Ky.*
Robinson, Franklin Duane,	4	Mech. Engin.	*Oneonta, N. Y.*

Robinson, Thomas Russell,	2	Arch.	*Dedham.*
Roche, James Thomas,	4	Gen. Sci.	*Worcester.*
Rockwell, Albert John,	3	Gen. Sci.	*Warren, Pa.*
Roloson, Robert Marshall,	1	Gen. Sci.	*Chicago, Ill.*
Ross, John McCombs,	2	Gen. Sci.	*Cleveland, O.*
Rossiter, Frank Heath,	1	Gen. Sci.	*New York, N. Y.*
Rotch, William, Jr.	2	Elec. Engin.	*Jamaica Plain.*
Rothschild, Monroe Reese,	2	Gen. Sci.	*Chicago, Ill.*
Ruland, Norman McLeod,	3	Gen. Sci.	*Brooklyn, N. Y.*
Ryan, Michael Healy,	4	Civ. Engin.	*Lynn.*
Sanborn, James Forrest,	4	Mining.	*Cambridgeport.*
Sawin, George Albert,	2	Elec. Engin.	*Cambridge.*
Schwill, Julius Orrin,	1	Gen. Sci.	*Cincinnati, O.*
Scott, Russell Gordon,	*S.*	Chem.	*Medford.*
Shannon, John Francis,	*S.*	Hyg.	*Roxbury.*
Shapleigh, Rogers Wentworth,	1	Chem.	*Newton.*
Shaughnessy, Charles Stephen,	2	Civ. Engin.	*Ashland.*
Sheldon, Arthur Noyes,	4	Mech. Engin.	*Providence, R.I.*
Shepard, Frederick Mead,	1	Elec. Engin.	*Fanwood, N.J.*
Shertzer, Tyrrell Bradbury,	3	Civ. Engin.	*Baltimore, Md.*
Shirk, Elbert Walker,	1	Gen. Sci.	*Peru, Ind.*
Shute, Bruce Thurber,	*S.*	Gen. Sci.	*Chicago, Ill.*
Singer, Sidney Kent,	2	Chem.	*Chicago, Ill.*
Skinner, Harry Hooker,	*S.*	Mech. Engin.	*Des Moines, Ia.*
Sloane, William Wilson,	1	Gen. Sci.	*Buffalo, N. Y.*
Slocum, Curlys Lyon,	4	Civ. Engin.	*New London, Conn.*
Smith, Arthur Morgan,	1	Gen. Sci.	*Quincy, Ill.*
Smith, Albert Ross,	2	Mech. Engin.	*Chelsea.*
Solomonson, Shandor Harry,	2	Chem.	*Cleveland, O.*
Somes, John Edward,	2	Arch.	*Gloucester.*
Spear, LeRoy Freeman,	1	Hyg.	*Walpole.*
Sprague, Percy Theodore,	*S.*	Elec. Engin.	*Watertown.*
Stevens, Edward Winslow,	4	Mech. Engin.	*Cambridge.*
Stevens, Sidney,	3	Mech. Engin.	*Ludlow.*
Stevenson, Charles Royal,	1	Mining.	*Buffalo, N. Y.*
Stoddard, Alexander Elliot,	1	Civ. Engin.	*Cohasset.*
Stone, Ralph Edgarton,	*S.*	Hyg.	*Waltham.*
Sturgis, Arthur,	3	Elec. Engin.	*New York, N. Y.*
Sullivan, Walter,	1	Hyg.	*San Antonio, Tex.*
Talbot, Charles Nicoll,	4	Gen. Sci.	*New York, N. Y.*
Taylor, Brainerd,	1	Hyg.	*Newtonville.*
Taylor, George Robert,	2	Elec. Engin.	*Youngstown, O.*
Taylor, Ralph Slater,	1	Mech. Engin.	*Melrose Highlands.*

Terbush, Myron Emmet,	3	Elec. Engin.	*Owego, N. Y.*
Tevis, Robert,	*S.*	Gen. Sci.	*Louisville, Ky.*
Thayer, Cranston Swift,	3	Elec. Engin.	*Cambridge.*
Thayer, Farwell Edward,	1	Arch.	*Cambridge.*
Thayer, Nathaniel Augustine,	1	Civ. Engin.	*Wollaston.*
Thomas, Egbert Eldridge,	2	Gen. Sci.	*Highland Falls, N. Y.*
Tone, Frederick Isaac,	*S.*	Mech. Engin.	*Des Moines, Ia.*
Tower, William Lawrence,	4	Biology.	*Cambridge.*
Townsend, Frederic de Peyster,	*S.*	Arch.	*Cambridge.*
Tucker, Herman Franklin,	2	Civ. Engin.	*Kendal Green.*
Vanderbilt, William Kissam,	1	Geol.	*New York, N. Y.*
Vaughan, Frank Apthorp,	3	Mech. Engin.	*Cambridge.*
Walker, Chester Sargent,	1	Chem.	*Chelsea.*
Walker, Robert Salisbury,	1	Civ. Engin.	*Brookline.*
Wallace, Henry Whitney,	3	Mech. Engin.	*Steubenville, O.*
Ward, Harry C,	4	Elec. Engin.	*Greenfield, Tenn.*
Wardwell, Frank Wellington,	1	Gen. Sci.	*Cleveland, O.*
Wardwell, Louis Edward,	2	Hyg.	*Cambridge.*
Ware, John,	4	Civ. Engin.	*E. Milton.*
Warner, William Skinner,	1	Mech. Engin.	*Dorchester.*
Warnock, William Alfred,	1	Gen. Sci.	*Cambridge.*
Warren, Leicester,	3	Gen. Sci.	*Cambridge.*
Waterhouse, Harold Pillsbury,	1	Gen. Sci.	*Melrose.*
Watson, Ralph Hopkins,	3	Mining.	*W. Somerville.*
Watson, Robert Henderson,	*S.*	Gen. Sci.	*Allegheny City, Pa.*
Wead, Harold Kasson,	1	Gen. Sci.	*Brookline.*
Weld, Christopher Minot, A.B. 1897,	1	Mining.	*Jamaica Plain.*
Wells, James Ogden,	3	Elec. Engin.	*St. Joseph, Mich.*
Wheeler, Homer Charles,	1	Mech. Engin.	*Peterboro, N. H.*
Wheeler, Henry Hamilton,	1	Hyg.	*Spencer.*
White, Richard Albert, S.B. (*Kentucky Univ.*) 1895,	4	Elec. Engin.	*Cave City, Ky.*
White, William Tillson,	1	Arch.	*Rockland, Me.*
Whitfield, Henry Davis,	4	Arch.	*New York, N. Y.*
Whiting, Percy Hollister,	1	Hyg.	*Great Barrington.*
Whitman, Clarence Morton,	4	Gen. Sci.	*Kotonah, N. Y.*
Whitney, Clifford Brigham,	1	Gen. Sci.	*Lincoln.*
Whitney, George Brackett,	2	Mech. Engin.	*Newton.*
Whiton, Herbert Starkes,	2	Mech. Engin.	*Hingham Centre.*
Whittemore, Wyman,	1	Geol.	*New Bedford.*
Whittier, Edward James,	2	Mech. Engin.	*Boston.*
Whorf, Stephen Cook,	2	Gen. Sci.	*Provincetown.*

Wilcock, Frederick,	3	Civ. Engin.	*Brooklyn, N. Y.*
Williams, Edward Cary,	1	Gen. Sci.	*Boston.*
Williams, John Henry Gardner,	1	Civ. Engin.	*Springfield.*
Williams, Simon Everard, PH.G. (*N. Y. Coll. of Pharmacy*),	3	Chem.	*Mt. Vernon, N. Y.*
Wilson, Louis Thornton,	4	Hyg.	*Worcester.*
Winter, John Barthol,	1	Elec. Engin.	*Buffalo, N. Y.*
Wiswell, Herbert Joseph,	1	Civ. Engin.	*Cambridge.*
Wolbach, Edwin Joseph,	4	Gen. Sci.	*Grand Island, Neb.*
Wolbach, Simeon Ben,	2	Gen. Sci.	*Grand Island, Neb.*
Wood, William Barry,	1	Gen. Sci.	*Brookline.*
Woods, Charles Royal,	3	Elec. Engin.	*Cambridge.*
Wright, Augustus Edward,	2	Arch.	*Fayville.*
Wright, Reuben Irving,	*S.*	Elec. Engin.	*Denison, Tex.*
Wyllys-Pomeroy, Samuel Wyllys,	*S.*	Civ. Engin.	*New York, N. Y.*

SUMMARY.

Fourth Year Students	51
Third " "	58
Second " "	96
First " "	153
Special "	67
Total	425

Civil Engineering	57
Electrical Engineering	40
Mechanical Engineering	66
Mining Engineering	21
Architecture	39
Chemistry	24
Geology	17
Biology	8
Anatomy and Physiology	36
For Teachers of Science	8
General Science	109
Total	425

THE SCIENTIFIC SCHOOL.

ADMISSION.

A student who desires to become a candidate for the degree of Bachelor of Science may obtain admission to the Lawrence Scientific School by passing an examination; or, if he comes from another college or scientific school, he may be admitted without complete examination. For the admission of students from other colleges and scientific schools see p. 59. For the admission of Special Students see p. 59.

Examinations for admission are held in June both at Cambridge and at the places named on p. 55; in September at Cambridge only. For the regulations concerning division of the examination between two years or between June and September of the same year, see p. 54. For the hours set for examinations, see p. 57.

Testimonials.

Every candidate for admission is required to furnish a testimonial of honorable dismissal from the school or college which he has attended, or from the tutor with whom he has studied. Testimonials may be presented at the time of the Final Examination. When a candidate has been in regular attendance at a school or academy during the year preceding his Final Examination, a testimonial from a private tutor will not in itself be sufficient.

Certificates.

A certificate of preparation is required of every candidate for a Preliminary Examination. There is a prescribed form for this certificate, see p. 54. No certificate of preparation is required of a candidate for Final Examination, or of one who postpones part of his examination from June to September in the same year.

Notice Required.

Candidates who wish to be examined in any place other than Cambridge, are required to give notice to the Corresponding Secretary of the University. The notice must be in the Secretary's hands not later than June 10. Candidates who intend to take any of the examinations of the first day must mention their intention in their notice.

Fees.

No fee is charged for examination in Cambridge.

A fee of five dollars must be paid *in advance* by every candidate who is examined at any place other than Cambridge. The whole fee of a candi-

date who proposes to divide his examinations is to be paid before his first examination: it should be sent by check, post-office order, or registered letter, to CHARLES F. MASON, Bursar, Cambridge, Mass., and should be in the Bursar's hands not later than June 10.

Persons who do not intend to enter the Scientific School will be admitted to the examinations at places other than Cambridge on payment of a fee of five dollars; and, if successful, will receive certificates to that effect.

ADMISSION REQUIREMENTS.

The following statement of requirements for admission to the Lawrence Scientific School has received the approval of the governing boards. The plan contemplates bringing the admission requirements up to substantial equality with those of Harvard College by adding new subjects from time to time.

In those studies which may be used for admission either to Harvard College or to the Scientific School, the examinations will be identical, a fixed examination being held in each study for all candidates who offer themselves in that study.

The studies which may be presented in satisfaction of the requirements for admission to the Lawrence Scientific School are named in the following list.

The number placed before each study is that which designates it in the "New Definitions of Requirements" in the Harvard University Catalogue.

The figure which follows each study indicates the relative *weight* which it is proposed to give to it in determining the question of the candidate's fitness for admission; but the weights, as well as other features of the plan, are subject to future modification.

This plan when in complete operation in **1903** will include the studies indicated below.

For requirements in **1899** and **1900** see p. 37.

Group I.

(All the studies of this group are prescribed, except that Advanced German may be offered in place of Elementary French, or Advanced French in place of Elementary German.)

ELEMENTARY.

1. English (*4*).
8. German (*2*).
10. French (*2*).
12. { History of Greece and Rome (*2*) or
History of the United States and England (*2*).
14. Algebra (*2*).
15. Geometry (*3*).

Group II.

Either of the first two studies or any two of the last five studies of this group must be offered. It is recommended that Physics be selected.

ELEMENTARY.

18. Physics (*2*).
19. Chemistry (*2*).
20. Physiography (*1*).
21. Anatomy, Physiology, and Hygiene (*1*).
25. Botany (*1*).
26. Zoölogy (*1*).

ADVANCED.

24. Astronomy (*1*).

Group III.

ELEMENTARY.

2. Greek (*3*).*
5. Latin (*4*).
8. German (*2*).
10. French (*2*). } (See remark under Group I.)

Drawing, { **31.** Freehand (*1*). **32.** Projections (*1*).

Shopwork, { **27.** Wood-working (*1*). **28.** Blacksmithing (*1*). **29.** Chipping, Filing, and Finishing (*1*). **30.** Machine-tool Work (*1*).

ADVANCED.

9. German (*2*).
11. French (*2*).
16. Logarithms and Trigonometry (*2*).
17. Algebra (*2*).
22. Physics (*2*).
23. Meteorology (*1*).

No candidate can offer an advanced study who has not offered the corresponding elementary study; but Physics is considered elementary with respect to Meteorology, and Geometry with respect to Astronomy.

Many of the studies in Groups II and III will serve to anticipate like studies prescribed in one or more of the various programmes leading to the degree of Bachelor of Science. Candidates will be able to ascertain which subjects are anticipatory by consulting the schedule of studies on pp. 64–104.

* Elementary Greek offered without Latin will count 4.

In **1899** a candidate may satisfy the requirements for admission by passing the examinations in the following studies: —

1.	English	4
8.	German*	2
10.	French*	2
12.	History	2
14.	Algebra	2
15.	Geometry†	3

In addition to the above he will be required to offer: —

18.	Physics or	
19.	Chemistry	
	or any two of the following studies: —	
20.	Physiography	2
21.	Anatomy, Physiology and Hygiene	17
26.	Zoölogy	
25.	Botany	
24.	Astronomy	

In **1900** in addition to the studies required in **1899**, candidates will be required to pass examinations in studies aggregating 2 points, selected from Groups II or III, making a total of 19 points.

NEW DEFINITIONS OF REQUIREMENTS.‡

Good English.

Clear and idiomatic English is expected in all examination-papers and note-books written by candidates for admission. Teachers are requested to insist on good English, not only in translations, but in every exercise in which the pupil has occasion to write or to speak English.

1. English.

(As at present.)

The examination will consist of two parts, which, however, cannot be taken separately: —

I. The candidate will be required to write a paragraph or two on each of several topics chosen by him from a considerable number — perhaps ten or fifteen — set before him on the examination paper.

* Advanced German (**9**) may be offered in place of Elementary French, or Advanced French (**11**) in place of Elementary German.

† Until 1903 Plane Geometry may be offered instead of Geometry but it will count as *one* point only and Solid Geometry will then be considered as a "condition."

‡ In the examinations of 1899, and thereafter until the new definitions shall be exclusively in force, *alternative papers* will be offered under the old definitions (where they differ materially from the present definitions) in Greek, Latin, German, French, History, Mathematics, Physics, and Chemistry.

The works prescribed for this part of the examination in **1899, 1900** and **1901** are as follows: —

In 1899: Dryden's Palamon and Arcite; Pope's Iliad, Books I, VI, XXII, and XXIV; The Sir Roger de Coverley Papers in the Spectator; Goldsmith's Vicar of Wakefield; Coleridge's Ancient Mariner; De Quincey's Flight of a Tartar Tribe; Cooper's Last of the Mohicans; Lowell's Vision of Sir Launfal; Hawthorne's House of the Seven Gables.

In 1900: Dryden's Palamon and Arcite; Pope's Iliad, Books I, VI, XXII, and XXIV; The Sir Roger de Coverley Papers in the Spectator; Goldsmith's Vicar of Wakefield; Scott's Ivanhoe; De Quincey's Flight of a Tartar Tribe; Cooper's Last of the Mohicans; Tennyson's Princess; Lowell's Vision of Sir Launfal.

In 1901: Shakspere's Merchant of Venice; Pope's Iliad, Books I, VI, XXII, and XXIV; The Sir Roger de Coverley Papers in the Spectator; Goldsmith's Vicar of Wakefield; Coleridge's Ancient Mariner; Scott's Ivanhoe; Cooper's Last of the Mohicans; Tennyson's Princess; Lowell's Vision of Sir Launfal; George Eliot's Silas Marner.

The candidate is expected to read intelligently *all* the books prescribed. He should read them as he reads other books; he is expected, not to know them minutely, but to have freshly in mind their most important parts. In every case the examiner will regard knowledge of the book as less important than ability to write English.

As additional evidence of preparation, the candidate may present an exercise book, properly certified by his instructor, containing compositions or other written work.

II. A certain number of books will be prescribed for careful study. This part of the examination will be upon subject-matter, literary form, and logical structure, and will also test the candidate's ability to express his knowledge with clearness and accuracy. The books prescribed for this part of the examination in **1899, 1900** and **1901** are as follows: —

In 1899: Shakspere's Macbeth; Milton's Paradise Lost, Books I and II; Burke's Speech on Conciliation with America; Carlyle's Essay on Burns.

In 1900: Shakspere's Macbeth; Milton's Paradise Lost, Books I and II; Burke's Speech on Conciliation with America; Macaulay's Essays on Milton and Addison.

In 1901: Shakspere's Macbeth; Milton's Lycidas, Comus, L'Allegro and Il Penseroso; Burke's Speech on Conciliation with America; Macaulay's Essays on Milton and Addison.

No candidate will be accepted in English whose work is seriously defective in point of spelling, punctuation, grammar, or division into paragraphs.

In connection with the reading and study of the prescribed books, parallel or subsidiary reading should be encouraged, and a considerable amount of English poetry should be committed to memory. The essentials of English grammar should not be neglected in preparatory study.

The English written by a candidate in any of his examination-books may be regarded as part of his examination in English, in case the evidence afforded by the examination-book in English is insufficient.

Greek.

2. *Elementary Greek.*

The examination will be adapted to the proficiency of those who have studied Greek in a systematic course of five exercises a week, extending through at least *two* school years. The two parts of the examination cannot be taken separately: —

(*a*) The translation at sight of simple Attic prose. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) A thorough examination on a prescribed portion of Xenophon (about thirty pages*), directed to testing the candidate's mastery of the ordinary forms, constructions, and idioms of the language; the test to consist, in part, of writing simple Attic prose, involving the use of such words, constructions, and idioms only as occur in the portion of Xenophon prescribed.

For three years, beginning with 1898, the portion of Xenophon prescribed will be the second book of the Anabasis.

In preparation for the elementary examination in Greek, candidates should read from 130 to 170 pages* of Attic prose.

The pupil should be constantly guided in proper methods of reading, and trained to read the Greek intelligently, as Greek, before undertaking to render it into idiomatic English. There should be constant practice in reading aloud, with due expression, and in hearing the language read. In connection with the reading, to ensure thoroughness and accuracy in the pupil's understanding of the language, the study of grammar, with some practice in writing Greek, should be maintained throughout the course. There should also be frequent written translations into idiomatic English.

Latin.

5. *Elementary Latin.*

The examination will be adapted to the proficiency of those who have studied Latin in a systematic course of five lessons a week, extending through at least *three* school years. The two parts of the examination cannot be taken separately: —

* The pages of the more recent Teubner text editions are taken as a standard in this statement.

(*a*) The translation at sight of simple Latin prose and verse. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) A thorough examination on a prescribed portion of Cicero's speeches (about thirty pages*), directed to testing the candidate's mastery of the ordinary forms, constructions, and idioms of the language; the test to consist, in part, of writing simple Latin prose, involving the use of such words, constructions, and idioms only as occur in the speeches prescribed.

For three years, beginning with 1898, the portion of Cicero prescribed will be the second, third, and fourth speeches against Catiline.

The course of reading pursued in preparation for the examinations in Latin should include: —

(*a*) Easy reading, included in or following a suitable introductory book ('Latin Lessons'), amounting to from 30 to 40 pages;*

(*b*) Nepos (Lives) and Caesar (Gallic War), 90 to 120 pages;

(*c*) Cicero, 90 to 120 pages, including the four speeches against Catiline and the speech on the Manilian Law, with additional speeches selected by the teacher;

(*d*) Virgil and Ovid, 6000 to 10,000 verses, including the first six books of the Aeneid.

Preparation for the elementary examination alone should include (*a*) and (*b*), the four speeches against Catiline, and from 2000 to 3000 verses of Virgil, or of Ovid and Virgil.

The pupil should be constantly guided in proper methods of reading, and trained to read the Latin intelligently, as Latin, before undertaking to render it into idiomatic English. There should be constant practice in reading aloud, with due expression, and in hearing the language read. In connection with the reading, to ensure thoroughness and accuracy in the pupil's understanding of the language, the study of grammar, with some practice in writing Latin, should be maintained throughout the course. There should also be frequent written translations into idiomatic English.

German.

8. *Elementary German.*

(*a*) The translation at sight of simple German prose. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) The translation into German of simple English sentences, or of easy connected prose, to test the candidate's familiarity with elementary grammar.

* See footnote, p. 39.

The passages set for translation into English will be suited to the proficiency of candidates who have read not less than two hundred pages of easy German (including reading at sight in class).

Grammar should be studied concurrently with the reading as an indispensable means of ensuring thoroughness and accuracy in the understanding of the language. The requirement in elementary grammar includes the conjugation of the weak and the more usual strong verbs; the declension of articles, adjectives, pronouns, and such nouns as are readily classified; the commoner prepositions; the simpler uses of the modal auxiliaries: the elements of syntax, especially the rules governing the order of words.

Pronunciation should be carefully taught, and the pupils should have frequent opportunities to hear German spoken or read aloud. The writing of German from dictation is recommended as a useful exercise.

9. *Advanced German.*

(*a*) The translation at sight of ordinary German. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) The translation into German of a connected passage of English prose, to test the candidate's familiarity with grammar. Proficiency in grammar may also be tested by direct questions.

The passages set for translation into English will be suited to the proficiency of those who have read, in addition to the amount specified under Elementary German, not less than five hundred pages of classical and contemporary prose and verse. It is recommended that the reading be selected from such works as the following: Riehl, *Culturgeschichtliche Novellen;* Freytag, *Bilder aus der deutschen Vergangenheit, Die Journalisten;* Kohlrausch, *Das Jahr 1813;* Schiller, *Der dreissigjährige Kreig, Wilhelm Tell, Maria Stuart, Die Jungfrau von Orleans;* Goethe, *Hermann und Dorothea, Egmont, Iphigenie;* Lessing, *Minna von Barnhelm.* About one half of the amount read should be Nineteenth Century prose.

In the translation into German candidates will be expected to show a thorough knowledge of accidence, the elements of word-formation, the principal uses of prepositions and conjunctions, and the essentials of syntax, especially the use of the modal auxiliaries, and of the subjunctive and infinitive modes.

It is recommended that the candidate be trained to follow a recitation conducted in German and to answer in that language questions asked by the instructor.

French.

10. *Elementary French.*

(*a*) The translation at sight of ordinary Nineteenth Century prose. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) The translation into French of simple English sentences or of easy connected prose, to test the candidate's familiarity with elementary grammar. Proficiency in grammar may also be tested by direct questions, based on the passages set for translation under (*a*).

The passages set for translation into English will be suited to the proficiency of candidates who have read not less than four hundred pages (including reading at sight in class) from the works of at least three different authors. It is desirable that a portion of the reading should be from works other than works of fiction.

Grammar should be studied concurrently with the reading as an indispensable means of ensuring thoroughness and accuracy in the understanding of the language. The requirement in elementary grammar includes the conjugations of regular verbs, of the more frequent irregular verbs, such as *aller*, *envoyer*, *tenir*, *pouvoir*, *voir*, *vouloir*, *dire*, *savoir*, *faire*, and those belonging to the classes represented by *ouvrir*, *dormir*, *connaître*, *conduire*, and *craindre*; the forms and positions of personal pronouns and of possessive, demonstrative, and interrogative adjectives; the inflection of nouns and adjectives for gender and number, except rare cases; the use of articles, and the partitive constructions.

Pronunciation should be carefully taught, and pupils should have frequent opportunities to hear French spoken or read aloud. The writing of French from dictation is recommended as a useful exercise.

11. *Advanced French.*

(*a*) The translation at sight of standard French. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) The translation into French of a connected passage of English prose, to test the candidate's familiarity with grammar. Proficiency in grammar may also be tested by direct questions.

The passages set for translation into English will be suited to the proficiency of candidates who have read, in addition to the amount specified under Elementary French, not less than six hundred pages of prose and verse from the writings of at least four standard authors. A considerable part of the amount read should be carefully translated into idiomatic English.

Candidates will be expected to show a thorough knowledge of accidence and familiarity with the essentials of French syntax, especially the uses of tenses, modes, prepositions, and conjunctions.

It is recommended that the candidate be trained to follow a recitation conducted in French and to answer in that language questions asked by the instructor.

History (including Historical Geography).

12. *Elementary History.*

Either of the two following groups, each including two fields of historical study: —

1. *Greek and Roman History.* — (*a*) Greek History to the death of Alexander, with due reference to Greek life, literature, and art. (*b*) Roman History to the accession of Commodus, with due reference to literature and government.

2. *English and American History.* — (*a*) English History, with due reference to social and political development. (*b*) American History, with the elements of Civil Government.

For preparation in each of the two historical fields presented, a course of study equivalent to at least three lessons a week for one year will be necessary.

The candidate will be expected to show on examination such general knowledge of each field as may be acquired from the study of an accurate text-book of not less than 300 pages, supplemented by suitable parallel readings amounting to not less than 500 pages. The examination will call for comparison of historical characters, periods, and events, and in general for the exercise of judgment as well as of memory. Geographical knowledge will be tested by means of an outline map.

As further evidence of the candidate's proficiency satisfactory written work, done at school and certified by the teacher, must be submitted at the time of the examination. It must be presented in the form of a note-book (or bound collection of notes), containing not less than 50 written pages on each historical field offered, and must show practice in some of the following exercises: —

(*a*) Notes and digests of the pupil's reading outside of the text-books.

(*b*) Brief written tests requiring the application to new questions of knowledge previously acquired.

(*c*) Parallels between historical characters of periods.

(*d*) Short studies of topics limited in scope, prepared outside of the class-room and illustrated by some reference to contemporary material.

(*e*) Historical maps or charts showing explorations, migrations, conquests, territorial changes, or social conditions.

In the judgment of the Department of History it is desirable that Greek and Roman History be offered as a part of the preparation of every candidate.

Mathematics.

A thorough practical acquaintance with ordinary Arithmetic is assumed as underlying all preparation in Mathematics. Knowledge of the fundamental principles of Arithmetic and careful training in accurate computation with whole numbers and with vulgar and decimal fractions form an essential part of early school work. But the pupil's time should not be wasted in the solution by arithmetic of puzzling problems which properly belong to algebra, or in complicated and useless reductions, or in the details of commercial arithmetic. It is desirable that some familiarity with algebraic expressions and symbols, including the methods of solving simple equations, be acquired in connection with the course in Arithmetic.

Elementary Mathematics.

14. *Elementary Algebra.*—Algebra, through Quadratic Equations.

The requirement in Algebra includes the following subjects: factors, common divisors and multiples, fractions, ratios and proportions; negative quantities and the interpretation of negative results; the doctrine of exponents; radicals and equations involving radicals; the binomial theorem for positive integral powers of the binomial, and the extraction of roots; putting questions into equations and the reduction of equations; the ordinary methods of elimination and the solution of both numerical and literal equations of the first and second degrees with one or more unknown quantities and of problems leading to such equations.

The student should cover carefully the whole ground here specified, and should acquire a thorough understanding not only of the practice, but of the reasons involved in the elementary algebraic rules; for example, in the rules of multiplication, of signs, and of exponents, in the rules for fractions, and in those relating to the reduction and solution of equations. He should train himself to practical skill by the solution of a large number of examples, and should learn to do his work with reasonable quickness, as well as with confidence, accuracy, and clearness. The solution of fairly complicated literal quadratics, the various methods of elimination for equations of the first two degrees, the putting of problems in a neat manner into equations, and the working of the various algebraic operations both for integral and fractional expressions may be mentioned as important subjects of attention. The student should be taught to arrange his work in a clear, orderly, and compact fashion.

The time supposed to be devoted to the systematic study of the requirement in Algebra is the equivalent of a course of three lessons a week through two school years.

15. *Geometry.* — Plane and Solid Geometry, including problems in mensuration of plane and solid figures, and original propositions in Plane Geometry.

Geometric education should begin in the kindergarten or primary school, where the child should acquire familiarity through the senses with simple geometric forms, by inspecting, drawing, modelling, and measuring them, and noting their more obvious relations. This study should be followed, in the grammar school, by systematic instruction in Concrete (or Observational) Geometry, of which geometric drawing should form a part. Such instruction should include the main facts of Plane and Solid Geometry, treated as matters of observation, and not as exercises in logical deduction, without however necessarily excluding the beginnings of deductive proof as soon as the pupil is ready for them. Concrete Geometry is believed to have important educational value, and to prepare an excellent foundation for the later study of Formal Geometry. It belongs, however, to the earlier stages of school work, and should not be postponed until the time that belongs to direct preparation for college or the scientific school.

In teaching Formal Geometry, stress should be laid from the outset on accuracy of statement and elegance of form, as well as on clear and strict reasoning. As soon as the pupil has begun to acquire the art of rigorous demonstration, his work should cease to be merely receptive, he should be trained to devise constructions and demonstrations for himself, and this training should be carried through the whole of the work in Plane Geometry. Teachers are advised, in their selection of a text-book, to choose one having a clear tendency to call out the pupil's own powers of thought, prevent the formation of mechanical habits of study, and encourage the concentration of mind which it is a part of the discipline of mathematical study to foster. The subject of Geometry, not a particular treatise, is what the pupil should be set to learn; and its simpler methods and conceptions should be made a part of his habitual and instinctive thought. Lastly, the pupil should be stimulated to good work by interest in the study felt and exhibited by the teacher.

The requirement in Geometry embraces the following topics: the general properties of plane rectilinear figures; the circle and the measure of angles; similar polygons; areas; regular polygons, and the measure of the circle; the relations of planes and lines in space; the properties and measure of prisms, pyramids, cylinders, and cones; the sphere and the spherical triangle. The propositions required under these several heads are those only which are contained in the older treatises,

and which are recognized as constituting the Elements of Geometry. The examination does not include the additions introduced into some recent text-books, although most of those additions are in themselves valuable for the student who has time and taste for extra study in this field. A syllabus of the required propositions has been prepared. [*This syllabus may be obtained, price 10 cents, at the Publication Office of Harvard University, 2 University Hall, Cambridge.*]

The examination in Geometry also includes original propositions in Plane Geometry, based on the propositions named in the syllabus, and problems in mensuration in both Plane and Solid Geometry; but excellence in bookwork and in exercises immediately illustrating bookwork will be allowed to offset in part any lack of skill in original work.

The time which it is recommended to assign to the systematic study of the requirement in Formal Geometry is the equivalent of a course of five lessons a week for one school year; but it is believed to be advisable to extend this allowance of time over two years.

15a. *Plane Geometry.*

Until the year 1903 Plane Geometry may be presented instead of Geometry, but it will have less weight in making up the required aggregate of points. This alternative will be withdrawn after 1903.

Advanced Mathematics.

16. *Logarithms and Trigonometry.* — The theory of logarithms and the use of logarithmic tables. — Plane trigonometry. — The solution of the right spherical triangle. — Applications to simple problems.

No technical knowledge of the subjects of surveying and navigation, such, for instance, as the methods of parallel or middle latitude sailing, will be required, but such terms as latitude, longitude, angle of elevation or depression, bearing, etc., should be understood. At the examination, candidates are furnished with four-place tables belonging to the University, and are not allowed to use their own tables. The tables provided are distributed before the hour of examination, so that candidates may have at least an hour for becoming acquainted with their arrangement and use. Teachers who wish a still earlier opportunity of seeing these tables should write to the Corresponding Secretary of the University.

17. *Advanced Algebra.*

The requirement in Advanced Algebra includes the following subjects:

(*a*) Simultaneous quadratics and equations solved like quadratics; properties of quadratic equations; addition, subtraction, multiplication and division of complex quantities; inequalities; variations; arithmetical

and geometrical progressions; mathematical induction; simple problems in choice and chance; continued fractions; scales of notation.

(*b*) Determinants, not including the multiplication theorem; simple applications of determinants to linear equations; the solution of numerical equations of higher degree, and so much of the theory of equations (not including multiple roots or Sturm's theorem) as is necessary for this purpose.

The topics included under (*a*) may be treated briefly. About half the time devoted to the requirements should be spent on the topics included under (*b*).

Physical Science.

Elementary Physical Science.

18. ***Elementary Physics.*** — A course of study dealing with the leading elementary facts and principles of physics, with quantitative laboratory work by the pupil.

The instruction given in this course should include qualitative lecture-room experiments, and should direct especial attention to the illustrations and applications of physical laws to be found in every-day life. The candidate is required to pass a written examination, the main object of which will be to determine how much he has profited by such instruction. This examination may include numerical problems. It will contain more questions than any one candidate is expected to answer, in order to make allowance for a considerable diversity of instruction in different schools.

The pupil's laboratory work should give practice in the observation and explanation of physical phenomena, some familiarity with methods of measurement, and some training of the hand and the eye in the direction of precision and skill. It should also be regarded as a means of fixing in the mind of the pupil a considerable variety of facts and principles. The candidate is required to pass a laboratory examination, the main object of which will be to determine how much he has profited by such a laboratory course.

The candidate must name as the basis for his laboratory examination at least thirty-five exercises selected from a list of about sixty, described in a publication issued by the University under the title, "Descriptive List of Elementary Exercises in Physics." In this list the divisions are mechanics (including hydrostatics), light, heat, sound, and electricity (with magnetism). At least ten of the exercises selected must be in mechanics. Any one of the four other divisions may be omitted altogether, but each of the three remaining divisions must be represented by at least three exercises.

The candidate is required to present a note-book in which he has recorded the steps and the results of his laboratory exercises, and this note-book

must bear the endorsement of his teacher, certifying that the notes are a true record of the pupil's work. It should contain an index of the exercises which it describes. These exercises need not be the same as those upon which the candidate presents himself for the laboratory examination, but should be equivalent to them in amount and grade of quantitative work.

The note-book is required as proof that the candidate has formed the habit of keeping a full and intelligible record of laboratory work through an extended course of experiments, and that his work has been of such a character as to raise a presumption in favor of his preparation for the examination. But much greater weight will be given to the laboratory examination than to the note-book in determining the candidate's attainments in physics. Experience has shown that pupils can make the original record of their observations entirely presentable, so that copying will be unnecessary, and they should in general be required to do so.

This course, if taken in the last year of the candidate's preparation, is expected to occupy in laboratory work, recitations, and lectures, five of the ordinary school periods, about fifty minutes in length, per week for the whole year. With few exceptions exercises like those in the Descriptive List already mentioned can be performed in a single school period, but for satisfactory results it will often be necessary to repeat an exercise. Two periods per week for the year should be sufficient for the laboratory work proper. If the course is begun much earlier than the last year of the candidate's preparation, as it well may be, it will require more time.

19. *Chemistry.* * — A course of at least sixty experiments, performed at school by the pupil and accompanied with systematic instruction in principles and their applications, in accordance with directions given in a pamphlet entitled "An Outline of Requirements in Chemistry," issued by the University for *the use of teachers only*.

The candidate is required to pass both a written and a laboratory examination. The written examination will test his acquaintance with the facts and principles of Chemistry. The laboratory examination will test both his skill in performing experiments and his grasp of the principles involved in them. The candidate is further required to present the original note-book in which he recorded the steps and results of the experiments which he performed at school, and this note-book must bear the endorsement of his teacher, certifying that the notes are a true record of the pupil's work. It should contain an index of the exercises which it describes.

* Equivalent to Chemistry *B*. The course will be mainly an experimental course in theoretical chemistry, but there will be experiments covering all branches of pure chemistry.

The note-book is required as proof that the candidate has formed the habit of keeping a full and intelligible record of laboratory work through an extended course of experiments, and that his work has been of such a character as to raise a presumption in favor of his preparation for the examination. But much greater weight will be given to the laboratory examination than to the note-book in determining the candidate's attainments in Chemistry.

20. *Physiography.* — A course of study equivalent to that described in a pamphlet entitled "An Outline of Requirements in Physiography," issued by the University.

For the form of examination see note under Astronomy, below.

21. *Anatomy, Physiology, and Hygiene.* * — A course of study and laboratory work equivalent to that described in a pamphlet entitled "An Outline of Requirements in Anatomy, Physiology, and Hygiene," issued by the University.

The candidate will be required to pass both a written and a laboratory examination. The written examination will test the range and thoroughness of his knowledge of the elements of Anatomy, Physiology, and Hygiene. The laboratory examination will test (*a*) his ability to perform the experiments described in the Outline of Requirements, and (*b*) his knowledge of the first aids to be rendered to the injured.

At the time of the written examination the candidate must present the original note-book containing (with dates) the notes and drawings he has made in the course of his laboratory work, and bearing the endorsement of his teacher, certifying that the book is a true record of the pupil's own observations and experiments. An index of subjects should be appended.

Advanced Physical Science.

22. *Advanced Physics.* †

The University does not prescribe the experiments to be performed by those offering this subject for admission. The work should, however, be of advanced grade, almost wholly quantitative, and conducted with apparatus, not necessarily elaborate, yet capable, if carefully handled, of yielding results of such accuracy as to warrant the consideration of somewhat minute error. For example, the balance used in weighing should be so delicate as to justify corrections for the buoyancy of the air on the weights and on the body weighed, and, in the determination of specific gravity, for the temperature of the water. The results should be discussed with reference to their precision and to the number of significant figures. There should be about sixty experiments well distributed through

* Equivalent to Hygiene 1 *hf*.

† Equivalent to, but not necessarily identical with, Physics *C*.

the range of general physics. If the student has devoted a considerable amount of time in the elementary course to experiments in heat, that division of physics may be here omitted. The laboratory work can be performed properly only in periods of considerable length, two to four hours, for example.

Instruction by lectures or text-books and work in problems should be a part of the course.

The candidate will be required to pass both a laboratory and a written examination. He should so thoroughly understand the work which he has performed as not to be confused in the laboratory examination by unfamiliar forms of apparatus.

The laboratory note-book will receive careful attention at the time of the examination. It must contain a certificate from the teacher that it is a true record of the candidate's work.

23. *Meteorology.* — A course of observational study equivalent to that described in a pamphlet entitled "An Outline of Requirements in Meteorology," issued by the University.

This course requires a knowledge of Elementary Physics. (For the form of examination see under Astronomy, below.)

24. *Astronomy.* — A course of observational study equivalent to that described in a pamphlet entitled "An Outline of Requirements in Astronomy," issued by the University.

This course requires a knowledge of Geometry.

In Physiography, Meteorology, and Astronomy, the candidate will be required to take both a written and a laboratory or practical examination. The written examination may test his understanding of observational methods appropriate to the subject, but will call chiefly for a knowledge of facts and principles. The laboratory or practical examination will test his skill in observation as well as his grasp of principles. This examination can be taken in Cambridge only; for those who are examined elsewhere in June, it will be postponed to September.

The laboratory examination in Physiography may include the description, explanation, and comparison of geographical features shown in photographs, maps, and models. The laboratory examination in Meteorology may include the use of instruments, the discussion of observations, and the construction and interpretation of weather maps and climatic charts. The practical examination in Astronomy may call for an ability to make simple naked-eye and instrumental observations, and to establish the simpler generalizations of astronomy by discussion of these observations.

The candidate in these subjects will be required to present, at the time of the laboratory or practical examination, the original note-book in which

he recorded, with dates, the steps and results of the observations which he made at school. This book must bear the endorsement of his teacher, certifying that the notes are a true record of the pupil's work. An index of subjects should be appended. The note-book is required as proof that the candidate has formed the habit of keeping a full and intelligible record of his work through an extended course of observational study, and that his work has been of a satisfactory character; but greater weight will be given to the practical or laboratory examination than to the note-book in determining the candidate's attainments.

Laboratory note-books will be deposited, after examination, in the College office, where they will be kept for a reasonable time, subject to the order of the owners.

Botany and Zoölogy.

25. *Botany.* — A course of study and laboratory work equivalent to that indicated in an "Outline of Requirements in Botany," issued by the University. The course should extend through at least half of a school year, with five lessons a week. The laboratory work is to be directed especially to the external anatomy and the activities of our common plants.

26. *Zoölogy.* — A course of study and laboratory work equivalent to that described in a pamphlet entitled "An Outline of Requirements in Zoölogy," issued by the University. The course should extend through at least half of a school year, with five lessons a week, and should include the laboratory study of at least ten types of animals, with special reference to their external anatomy and their activities. These types are to be selected in accordance with directions given in the pamphlet named.

In Botany and in Zoölogy the candidate will be required to pass both a written and a laboratory examination. The written examination will test the range and thoroughness of his knowledge of the subject. The laboratory examination will test his skill in observation and experimentation, and his ability to apply names properly to the parts of the organisms studied.

At the time of the written examination the candidate must present the original note-book containing (with dates) the notes and drawings he has made in the course of his laboratory work, and bearing the endorsement of his teacher, certifying that the book is a true record of the pupil's own observations and experiments. An index of subjects should be appended.

Shopwork.*

A course of instruction in the use of tools and in the ordinary processes employed in the working of wood or metal, equivalent to that described in a pamphlet entitled "An Outline of Requirements in Shopwork," issued by the University. The course may embrace one or more of the following divisions: —

27. *Wood-working;*
28. *Blacksmithing;*
29. *Chipping, Filing, and Fitting;*
30. *Machine-tool Work.*

The candidate must be familiar with the names, construction, and operation of the tools commonly used in these processes, and will be expected to read ordinary mechanical drawings and to make freehand sketches of articles which are to be produced in the workshop.

The candidate is required to pass both a written and a laboratory examination. The written examination will test his knowledge of tools and mechanical processes, and of the the properties of materials of common use in construction. He will be expected to show familiarity with approved methods for simple work in the branch in which he presents himself for examination, and to write an intelligible description of those methods, illustrated by such sketches as may be necessary to make them clear. The laboratory examination will test the candidate's skill in the use of tools. He will receive the materials and specifications for a piece of work, and will be expected to select his tools, preparing them for use if necessary, and to demonstrate satisfactorily his knowledge and skill.

Every candidate is further required to present the original note-book in which he entered the descriptions and sketches of the work he performed at school; and with this he may present, as evidence of his skill in the workshop, the models made by him at school. Both the note-book and the models must be accompanied by the endorsement of his teacher, certifying that the book is a true record, and that the models are specimens, of the pupil's own work.

Drawing.*

A course of drawing, in either or both of the following branches, equivalent to that described in an "Outline of Requirements in Drawing," issued by the University: —

31. *Freehand Drawing.* — The representation of simple objects, in outline and with shading.

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* Each of the courses numbered 27, 28, 29, 30, 31 and 32 is to be equivalent to a half-course in the Lawrence Scientific School.

Accuracy of delineation, correctness of proportion, and good quality of line are desired rather than any attempt at elaboration. The aim should be to express as much as possible with the fewest lines. The examination will consist of the drawing, first, of a group of geometrical solids, and, second, of either a simple piece of machinery or a simple piece of architectural ornament (such as a Greek anthemion), as the candidate may elect.

32. *Projections.* — The projection in plan and elevation of geometrical figures and of simple parts of architectural subjects or machinery.

The examination will test the candidate's knowledge of principles and methods. Every candidate is expected to bring to the examination the ordinary drawing instruments and lead-pencils; drawing-board and paper will be supplied. Every candidate is further required to present a set of plates or drawings prepared by him at school, sufficient to demonstrate his understanding of the subject and his familiarity with instruments, including the use of the right-line pen; and these drawings must be accompanied by the certificate of his teacher stating that they are the pupil's own work.

Laboratory Examinations.

The following provision is made for candidates for admission either to Harvard College or to the Lawrence Scientific School presenting themselves for examination outside of Cambridge in subjects in which a laboratory examination is required: —

A candidate examined in June at any place where a laboratory examination is not provided will be required to take such an examination in Cambridge in the autumn; but if he passes the written examination in June and presents a satisfactory note-book, the subject will be temporarily counted in his favor in determining the question of his admission to College. Similarly a Preliminary candidate is allowed to postpone his laboratory examination until September of the year in which he enters College.

Examination Papers.

A set of recent examination papers will be sent free to any address, on application to the Secretary of the School. Separate papers used during the last two years in any subject may be had in quantities of *not less than six* copies of any *one paper* (*not one each of six different papers*), at ten cents a dozen.

DIVISION OF THE EXAMINATION.

A candidate for admission may take the entire examination at one time; or he may divide it, under conditions named below (1) between two years, or (2) between June and September of the same year. In the former case he is known as a "Preliminary Candidate"; in the latter as a "Postponing Candidate." Teachers and candidates should carefully distinguish between the words "Preliminary" and "Postponing" as used at examinations for admission, since a careless use of one of these words for the other leads to serious misunderstanding. A Preliminary Examination is always taken a year or more before the Final Examination.

Postponing candidates — those who divide their examinations between June and September of the same year — are considered as taking Final Examinations at both the June and September periods.

1. Preliminary Examination.

A candidate may pass a Preliminary Examination in some studies in one year; and, on receiving a Preliminary Certificate, may pass a Final Examination in the remaining studies in some subsequent year. For the Preliminary Examination the candidate must present himself *in June*, having previously sent in a certificate of preparation; see below. No Preliminary Candidate will be examined in September without special permission from the Dean.

A Preliminary certificate will be granted to any candidate who passes two of the required subjects.

Candidates may offer themselves for the Preliminary Examination in any studies, Elementary or Advanced, *in which their teachers certify that they are prepared, and in no others.*

Certificate of Preparation.

The certificate of preparation for a Preliminary candidate must be in the following form: —

"..... has been my pupil for ..... years, and is, in my judgment, prepared to pass the Harvard Preliminary Examinations in the following studies: — . . Name of Teacher: ..... Name of School: ..... ~~Address~~: ....."

When a candidate has been in regular attendance at a school or academy for any part of the year preceding his Preliminary Examination, his certificate must be signed by the principal of that school or academy.

The certificates of Preliminary candidates must be in the hands of the Secretary of the Scientific School on or before June 21.

Candidates who have prepared themselves for the admission examinations should correspond with the Secretary of the School concerning their certificates.

2. Postponing.

A candidate who presents himself in June intending to pass the whole examination in the same year may postpone until September a part of his examination, but he will receive no credit for the examination held in June, unless he passes in at least two subjects. Candidates who divide the examination between June and September of the same year must register in June not as *Preliminary* but as *Final* candidates. In September they must present themselves at 8 A.M. on the *first day* of the Examinations, Wednesday, September 20 (see p. 57).

TIMES AND PLACES OF EXAMINATION.

Examination for Admission to the First-Year Class.

Two regular examinations for admission to the First-Year Class are held each year, — one at the beginning of the summer vacation, and the other before the beginning of the academic year in the autumn.

First Examination.

In 1899, the *first examination* will be held on Tuesday, Thursday, Friday, and Saturday, June 27, 29, and 30, and July 1.

Candidates who wish to take any of the examinations held on the first day must assemble punctually at 8 A.M. on that day. All other candidates must present themselves punctually at 8 A.M. on the second day.

The examinations will be held in the following places: —

In *Cambridge*, in Sever Hall.
In *Quincy*, in the rooms of the Adams Academy.
In *Andover*, in the rooms of the Phillips Academy.
In *Groton*, in the rooms of Groton School.
In *Southborough*, in the rooms of St. Mark's School.
In *Worcester*, in Curtis Hall, the Young Men's Christian Association building, Elm Street.
In *Springfield*, in the rooms of the Springfield High School.
In *South Byfield*, in the rooms of the Dummer Academy.
In *Exeter, N.H.*, in the rooms of Phillips Exeter Academy.
In *Concord, N.H.*, in the rooms of St. Paul's School.
In *Portland, Me.*, in the rooms of the Portland High School.
In *Pomfret Centre, Conn.*, in the rooms of the Pomfret School.
In *Washington, Conn.*, in the rooms of the Gunnery.
In *New York, N.Y.*, in the lecture-room of the Young Men's Christian Association, Twenty-third Street, corner of Fourth Avenue.
In *Garden City, N.Y.*, in the rooms of St. Paul's Cathedral School.
In *Albany, N.Y.*, in the rooms of the Young Men's Christian Association.

In *Buffalo*, *N. Y.*, in the High School building, corner of Court and Franklin Streets.

In *Philadelphia*, *Pa.*, in the rooms of the Young Men's Christian Association building, corner of Fifteenth and Chestnut Streets.

In *Pottstown*, *Pa.*, in the rooms of the Hill School.

In *Lawrenceville*, *N.J.*, in the rooms of the Lawrenceville School.

In *Washington*, *D.C.*, in the rooms of the Columbian University, corner Fifteenth and H Streets.

In *Louisville*, *Ky.*, in the rooms of the Young Men's Christian Association, corner of Fourth Avenue and Broadway.

In *Memphis*, *Tenn.*, in the rooms of the University School, 259 Poplar Street.

In *Milwaukee*, *Wis.*, in the rooms of the Young Men's Christian Association, 147 Fourth Street.

In *Cleveland*, *O.*, in the Central High School building.

In *Cincinnati*, *O.*, in the rooms of the Young Men's Christian Ass'n.

In *Youngstown*, *O.*, in the rooms of the Rayen School.

In *Chicago*, *Ill.*

In *St. Paul*, *Minn.*, in the rooms of the Young Men's Christian Association, West Fifth St., next to the Post Office.

In *St. Louis*, *Mo.*, in the Board of Education building, corner of Ninth and Locust Streets.

In *Kansas City*, *Mo.*, in Association Building, 810 Wyandotte St.

In *Omaha*, *Neb.*, in the rooms of the Public Library Building.

In *Denver*, *Col.*, in the rooms of the Denver High School (District No. 1), corner of Nineteenth and Stout Streets.

In *San Francisco*, *Cal.*, in the rooms of the Mechanics' Institute, 31 Post Street.

In *Belmont*, *Cal.*, in the rooms of the Belmont School.

In *Portland*, *Oregon*, in the lecture-room of the Portland Library.

In *Pasadena*, *Cal.*, in the rooms of the Classical School, 49 South Euclid Avenue.

In *Bonn*, *Germany*, at the Hotel Kley.

The University will ordinarily conduct the admission examinations in June in any school or city where a sufficient number of candidates shall present themselves for examination; provided that the school or city be not within easy reach of one of the regular places of examination. Applications for examinations in June, in schools or cities not named above, should be made to the Corresponding Secretary of Harvard University as early as April 1.

Notice Required.

For the notice and the fees required of candidates examined in any place other than Cambridge, see p. 34.

Second Examination.

The *second examination* will be held *in Cambridge only*, on Wednesday, Thursday, Friday, and Saturday, September 20, 21, 22 and 23.

Candidates who wish to take any of the examinations held on the first day must assemble punctually at 8 A.M. on that day. All other candidates must present themselves punctually at 8 A.M. on the second day.

Order of Examinations.

Tuesday, June 27, and Wednesday, September 20.

8 A.M. Candidates offering any of the subjects of the first day meet the officer in charge of the examinations.
9– 11. Advanced German.
11½–12½. Advanced Chemistry (written examination).
12¾– 1¾. Advanced Algebra.
2 – 3. Analytic Geometry.
3 – 4. Advanced Physics (written examination).
4 – 5. Logarithms and Trigonometry.
5 – 6. Solid Geometry.

Thursday, June 29, and Thursday, September 21.

8 A.M. Candidates meet the officer in charge of the examinations.
9–11. Elementary Latin.
11½–1½. Elementary Greek.
2½–3½. Latin Compos tion.
3¾–5¾. Advanced Latin.

Friday, June 30, and Friday, September 22.

8–9. Elementary Physics.
9½–11¼. Geometry (see p. 14).
9½–10¾. Plane Geometry.
11½–1. Elementary Algebra.
1½–3½. English.
3¾–5¾. Advanced Greek.

Saturday, July 1, and Saturday, September 23.

8–10. Advanced French.
10½–11¾. History.
12–1. Greek Composition.
1½–3. Elem. French (French *A*).
3½–4¾. Elem. German (German *A*).

Laboratory Examinations.

The stated time for the laboratory examination in Elementary Experimental Physics is Thursday, Friday, and Saturday of the examination periods; in Advanced Physics and Chemistry, Tuesday of the June period and Wednesday of the September period. On these days examinations are held in Cambridge only, and appointments for them will be made when the candidates meet the officer in charge of the examination.

In June, classes from schools near Cambridge may, by special arrangement, take the laboratory examinations in Physics and Chemistry on earlier days.

Laboratory examinations in Physics and Chemistry, but only for those who have previously passed the written examination and received a provisional mark (see p. 53), will be held as follows: Elementary and Advanced Physics on Wednesday, September 27, at 2 P.M. in the Jefferson Physical Laboratory, (these examinations, however, may, if desired, be taken at the stated times as given above); Advanced Chemistry on Wednesday, September 27, at 2 P.M. in Boylston Hall.

Anticipation of English *A*.

In 1899, and thereafter until further notice, a candidate for admission who has passed the examination in Elementary English with a grade of *A* or *B* may take a second examination, which, if passed with a grade of *A* or *B* shall exempt him from the prescription of English *A*.

At this examination, which will be held in September only, a candidate will write one or more compositions on topics to be selected by him from a list comprising subjects in English Literature, the Classics, French and German authors, History and Science. The examination will occupy two hours.

In 1899, the examination in English *A* will be held in accordance with the programme given below. This examination, formerly held in Cambridge only, is now held, *in June*, at all the places named on pages 55, 56.

Wednesday, June 28, and Tuesday, September 19.

3–5 P.M. English *A*.

Examinations in Other Prescribed Studies.

The examinations in French *A* and German *A* correspond to the admission examinations in Elementary French and German (see pp. 40–42), and will be held on *Saturday, July 1*, and *Saturday, September 23*.

Examinations in studies that are not equivalent to advanced admission studies are held only in the first fortnight of the academic year and only at Cambridge. Written notice of intention to take these examinations must be in the hands of the Corresponding Secretary not later than *September 10*. The examinations in such studies as correspond to advanced admission studies (see p. 57) are identical with the examinations in the latter, and must be taken at the same times and places.

ADMISSION TO ADVANCED STANDING.

A candidate may be admitted to advanced standing either by passing examinations in all the studies already pursued by the class for which he offers himself, in addition to the entrance examinations; or from another scientific school or college upon such conditions as the Administrative Board may deem equitable in each case, regard being had to the applicant's previous course of study, and to the evidence of proficiency exhibited by him.

The successful study of any subject in Harvard College is taken as an equivalent for the same subject in the Scientific School; but no Scientific School degree is given without at least one full year's work as a registered student in the School.

ADMISSION OF SPECIAL STUDENTS.

The courses of study in the Scientific School are open to persons who satisfy the Administrative Board of the School of their fitness to pursue the particular courses they elect, although they have not passed the usual examinations for admission. These students are known as Special Scientific Students; they are members of the School from the time of their admission, but are not candidates for the degrees given by the School.

Special Students are subject to all the regulations of the School. A report of their work is sent to their parents or guardians at the end of the year.

The Administrative Board reserves the right to deprive any Special Student of his privileges at any time, if he abuse or fail to use them.

A certificate of proficiency will be given, if desired, to any Special Student who has faithfully pursued his chosen subjects throughout a year and attained a grade not lower than Grade *B* therein.

(*Extract from the Regulations.*)

At the beginning of each year special students must submit their choice of studies for approval. They will be required to take each year at least four full courses selected from among the following: Courses in Mathematics, Engineering, Physics, Chemistry, Geology, Botany or Zoölogy, and any courses in other departments which are prescribed in the several departments of study for the degree of S.B.

At least one half of the work of each special student must be taken from the regular programme of the department of study in which he registers.

Candidates who cannot otherwise show that they are competent to pursue subjects which are protected by entrance examinations, must pass satisfactory tests before entering these courses.

FORM OF APPLICATION.

Persons who wish to enter the School with Advanced Standing or as Special Students will be furnished with printed forms of application by the Secretary of the School. The form must be filled out and returned to the Secretary before the application will be considered by the Administrative Board of the School.

REGULATIONS.

Petitions.

1. Every request from a student to the Administrative Board should be made in writing, and should be addressed to the Dean of the School.

Registration and Residence.

2. Every student is required to present himself for registration not later than Thursday, the first day of the academic year, between 9 A.M. and 1 P.M., at a place announced on the bulletin boards. He is further required to register not later than 12 M. on the first week-day after the Christmas recess and the first week-day after the April recess.

3. Continuous residence at the University is required during term-time. No interruption of residence is permissible, except for satisfactory reasons stated to the Secretary (orally, if possible) before the student leaves Cambridge. The student who has been absent must also report in person to the Secretary immediately on his return.

School Exercises.

4. A student prevented by illness or other cause from attending School exercises for a day or more must send notice to the Secretary without delay. Immediately on his return to duty, he must make, at the Secretary's office, a specific statement of the cause of his absence; and, if his explanation is satisfactory, his absence will be excused.

5. A student who fails to give an instructor a theme, forensic, or other written exercises at the appointed time will get no credit for it, unless he satisfies the Secretary that the delay was caused by serious illness or other unavoidable hindrance.

6. A student who has neglected the work of any course may be excluded from the course by the instructor with the approval of the Dean.

Enrolment.

7. Every student is required to hand to the officer with whom he registers at the beginning of the academic year a list of his studies *for the whole year*. This list must be written on a card provided for the purpose, and must be signed by his Adviser.

At the same time and on the same card, every student is required to enroll himself in each of his studies which begin in the first half-year, whether prescribed or elective.

8. It is of the utmost importance that the student should have fully considered and decided upon his plan of study before the first day of the year, as changes, either additions to, or subtractions from the lists then handed in, are not allowed except for causes which could not have been foreseen. Changes may be made only with the approval of the Adviser and permission of the Dean, to whom application must be made in writing (on a blank form to be obtained at the office) with a full statement of reasons.

9. A student who has obtained leave to change his studies must enroll with the Secretary immediately upon receiving notice that the change has been permitted.

The exercises are held at the hours set down in the Announcement and at places to be announced on the bulletin boards.

Extra Studies.

10. A student who wishes, without assuming all the responsibilities of a regular study, to attend the instruction of any course, may do so on obtaining leave of the instructor; but no record will be kept of his attendance, and he will receive no credit in the course.

Anticipatory Examinations.

11. Students who have anticipated studies in the Four Years' Course in which they are registered, shall take such other studies as the Administrative Board may designate.

Deficiencies.

12. A candidate may be admitted in spite of deficiencies in some of the admission subjects; but no candidate so admitted will be advanced to Third-Year standing in the School until he has made good such deficiencies to the satisfaction of the Administrative Board.

The exact number of deficiencies with which a candidate may be admitted cannot be named in advance, since each case is considered on its merits.

13. Students who have not received official notice of having passed all of the admission examinations in Mathematics must obtain the signature of the instructor of the First-Year Mathematics before registration in order to be allowed to enroll in the mathematical courses.

14. No student in the Engineering courses will be advanced to Second-Year standing until all his admission deficiencies in Mathematics are made good to the satisfaction of the Administrative Board.

15. Students of Mechanical and Electrical Engineering of the First-Year who have any admission condition, and those of the Second-Year who have either condition or deficiency will not be allowed to take the work-shop courses at the time appointed on the schedule, but will be required to take them during the following summer.

Promotion.

16. In order to be promoted to a higher class at the end of a school year, a student must have attained in that year grade *C* or higher in at least one half of his required work, and must not have an aggregate deficiency of more than two courses.

17. A student who has failed in any course of prescribed study must make up the deficiency by taking the same course in some following year, and he is barred from dependent courses until such deficiency is made good.

18. A student who has failed of promotion under the operation of rule 16 may be placed on probation unless the Dean is satisfied that the failure to be promoted is not due to neglect.

19. To obtain credit in a course of study, or to count the course towards fulfilment of the requirements for a degree, the student must have attended both the mid-year and the final examinations. This rule applies to all students, including suspended students and students on leave of absence.

Special Students.

20. At the beginning of each year special students must submit their choice of studies for approval. They will be required to take each year four full courses selected from among the following: Courses in Mathematics, Engineering, Physics, Chemistry, Geology, Botany or Zoölogy, and any courses in other departments which are prescribed in the several departments of study for the degree of S.B.

21. At least one half of the work of each special student must be taken from the regular programme of the department of study in which he registers.

22. Candidates who cannot otherwise show that they are competent to pursue subjects which are protected by entrance examinations, must pass satisfactory tests before entering these courses.

23. Exceptional cases may be referred to the Administrative Board by petition.

Examinations.

24. A student who has been absent from a mid-year examination, and has satisfied the Secretary that his absence was caused by serious illness or other unavoidable hindrance, is entitled to a second and last opportunity of passing the examination at some time during the period of the final examinations, provided he make written request for such examination before May 1.

25. A student who, having passed the mid-year examination in any course of study, has been absent from the final examination, and has satisfied the Secretary that his absence was caused by serious illness or other unavoidable hindrance, is entitled to a second and last opportunity of passing the examination at some time during the first fortnight of the ensuing academic year, provided he make written request for such examination before September 10.

26. No student is permitted to take any books or papers into an examination room except by express direction of the instructor. No communication is permitted between students in an examination room on any subject whatever.

27. If a student is tardy at an examination, he may not be admitted to it, and may be reported as absent.

Good Order.

28. No student shall lodge or board in any house disapproved by the Regent, or change his lodging without giving immediate notice to the Secretary.

29. No student shall refuse to give his name to an officer of the University. Every society of students shall give the Regent, at his request, a complete list of its officers and members.

30. No dramatic or musical society shall take part in an entertainment for money or out of the limits of Old Cambridge without permission of the Faculty Committee on Dramatic and Musical Entertainments.

Discipline.

31. Neglect of School work and offences against law and order will be dealt with as the Faculty or the Administrative Board shall determine. Discipline may be enforced by Admonition, Probation, Suspension, Dismissal, or Expulsion.

Admonition is warning notice to parent or guardian.

Probation means serious danger of separation from the University. A student on probation is not allowed to compete for scholarships, prizes, or honors, or to take part — whether with students or with other persons — in any public theatrical or musical performance or in any public athletic

contest; he cannot be restored to full standing without a special vote of the Administrative Board, and he cannot be recommended for a degree; he may be required to put himself under the direction of a private tutor approved by the Dean, or to report daily to an officer of the University, or to do both; and at any time, by vote of the Administrative Board, his probation may be closed and his connection with the University ended.

Suspension is temporary separation from the University, and may involve residence in a specified place and performance of specified tasks. A suspended student is not allowed to reside in Cambridge without the permission of the Administrative Board, or to visit Cambridge without the permission of the Dean, excepting at the period of the mid-year and final examinations. A suspended student is not allowed to take part in the public performances or games of any University association.

Dismissal closes a student's connection with the University, without necessarily precluding his return.

Expulsion is final separation from the University.

SCHEDULE OF STUDIES.

The courses are selected mainly from the Courses of Instruction provided by the Faculty of Arts and Sciences and described in the University Catalogue, under the headings which are here given in the brackets

The numbers and letters prefixed to the several courses are intended to be permanent, and no attempt is made to arrange them in a regular or complete series.

The Roman numeral in parentheses appended to each course indicates the examination group to which the course belongs.

COURSES OF FOUR YEARS IN ENGINEERING.

General Statement.

The description of the courses in Engineering is intended to aid young men in choosing their departments of study and to make clear the work before them in the school. The department of Engineering does not plan to train students in specialities at the risk of diminishing their grounding in the principles upon which all engineering depends. It is believed that they will obtain experience in specialities to the best advantage in the field, workshop, office, or laboratory, after graduation.

The courses of instruction extend over a period of four or five years, and lead to the following branches of the profession of engineering: —

1. Civil Engineering.
2. Electrical Engineering.
3. Mechanical Engineering.

As will be seen, the course in Civil Engineering includes instruction in Topographical, Sanitary, Hydraulic, Highway, Railroad, and Bridge Engineering, while the courses in Electrical and Mechanical Engineering cover all the applications of power to industrial purposes, which are usually classified under those branches. Each of these courses is closely allied to the other two, so that all of the instruction in Applied Mechanics and Resistance of Materials, and much of that in Hydraulics, Machinery and Boilers, the Measurement of Power, the testing of Materials, and Applied Electricity are common to all of them.

The first two years are given up mainly to studies which belong naturally to the undergraduate period and are so nearly the same in all the courses, that students find it comparatively easy to change from one branch to another, if they so desire after experience in the school. The last two years are devoted almost entirely to advanced studies which have a more immediate relation to professional work.

Buildings and Equipments.

The engineering laboratories are freely used in connection with all subjects which require models or machinery for clear and comprehensive treatment, and the department aims to give graduate students facilities for conducting investigations in Strength of Materials, Hydraulics, Steam, and Electricity.

The lecture rooms, draughting rooms, and laboratories for the instruction in engineering are situated in Lawrence Hall and the Rogers Building.

The Engineering Library and Reading Room, located on the second floor of the Lawrence Hall, contain more than 5000 volumes on engineering subjects, and are supplied with all the important foreign and American engineering periodicals.

The Surveying Instruments are kept on the first floor of the Lawrence Hall, and include a number of Transits, Levels, Solar Compasses, Plane Tables and Alidades, Hand Levels, Rods, Tapes and Chains.

Engineering Laboratories. The laboratory located in the Rogers Building (formerly the University gymnasium), contains the machinery, apparatus and instruments for giving instruction in the measurement of those quantities with which the engineer has to deal in the investigation of the properties of materials and the efficiencies of machines and prime movers.

The Steam Engineering plant includes a Manning boiler with feed water heater, several small steam engines, a Wheeler condenser, a steam driven Sturtevant blower available for forced draught, a Westinghouse

air compresser, and the necessary complement of instruments, such as pressure gauges, indicators, brakes, steam calorimeters, fuel calorimeters, and apparatus for the analysis of coal and of flue gases, the last including an "econometer" giving a continuous indication of the composition of the gases. An air thermometer, gauge tester, and indicator calibrating apparatus are available for purposes of standardization. The heat engine equipment includes two gas engines, one of which is convertible into a gasoline engine, air and gas meters, gas calorimeter, special indicators, Hempel gas analysis apparatus and other instruments.

For Testing Materials the laboratory contains a 200,000 lb. Olsen autographic machine capable of testing a four foot tension or compression piece, and a 20 ft. beam; a 60,000 lb. Riehle machine, Keep's cast iron testing machines, a cement testing machine with its accessories, and a number of extensometers, micrometers and the like.

The Testing of Road Materials is carried on in a small room partitioned off from the main laboratory and equipped with a Duval abrasion test machine, and a special impact machine.

The Hydraulic Plant includes a duplex Blake pump with a capacity of 1000 gallons per minute, supplying water to a closed steel tank or stand pipe, five feet in diameter and twenty-five feet high. Any head up to about 300 feet is obtained in the stand pipe by compressing air above the water, and is kept constant by means of a variable overflow. The discharge from the stand pipe takes place through an opening to which an orifice, nozzle, Pelton wheel or other turbine can be connected. Thence the water falls into a large wier tank with adjustable wier, over which it goes to two cast iron weighing tanks, each of about 6000 lbs. capacity, and is then discharged into the cistern which is also the supply well for the pump.

The laboratory also contains a machine for investigating the transmission of power by ropes or belts, Thurston's lubricant tester, Emerson's power scale and other apparatus.

The Electrical Engineering Laboratory. Previous to 1891, all of the instruction in experimental electricity was given in the Jefferson Physical Laboratory. In the Fall of that year the small two story annex in the rear of the L. S. S. Building was erected and equipped, the upper floor as a shop for the repair and construction of apparatus and the ground floor as a dynamo laboratory. Since that time the equipment has grown steadily and several rooms in the basement of the L. S. S. Building are now occupied.

Dynamo Room. Besides the 15 kilowatt, 500 volt motor which supplies power to the shop and laboratory, this room contains a considerable variety of direct and alternating current generators and motors, averaging

5 or 6 kilowatts capacity and all belted to the line shaft by means of friction clutches; lamp banks and rheostats of various kinds for the absorption of power, aggregating a total capacity of about 30 kilowatts; two sets of apparatus for the rapid delineation of alternating current and electromotive force curves; transformers, condensers, inductive and non-inductive resistances and other apparatus for alternating current experiments.

Five of the above mentioned dynamos and motors, three of the transformers and some of the auxiliary apparatus were designed by students and constructed in the shop. A three phase motor so designed, is supplied with several armatures (or secondaries), arranged to show the effect of varying the secondary resistance and inductance and the nature of the secondary winding. One of the transformers, designed for insulation tests, has a secondary electromotive force of 40,000 volts and a capacity of 15 kilowatts.

The 30 inch lathe in the shop is operated by means of a motor in the headstock. This is a successful example of the direct application of electric motors to the operation of slow speed machinery and exhibits one or two novel features. It was designed by students.

Two circuits, a 500 volt current power circuit and a 1000 volt alternating lighting circuit from the Cambridge Electric Light Company, are available for power, lighting, and experimental work.

The Instrument Room contains a large variety of portable measuring instruments, such as ammeters, voltmeters and wattmeters; one pair of Weston laboratory standard instruments used as secondary standards for the rapid calibration of ammeters, voltmeters and wattmeters; electrodynamometers; Kelvin composite balance and electrostatic voltmeters; and a large variety of apparatus for resistance measurements.

The Storage Battery Room contains one battery of thirteen 250 ampere-hour cells and one battery of one hundred and four 30 ampere-hour cells, besides a considerable number of portable cells of various sizes. The 30 ampere-hour cells are connected to a 105-point switch, so arranged that any number of the 104 cells may be connected, by means of a pair of push buttons in the instrument room, to the volt-meter calibrating circuit which leads into the latter place.

The Arc Lamp Room contains a variety of open and closed arc lamps for direct and alternating currents.

The Photometer Room contains a five-meter photometer of the Reichsanstalt pattern with Lummer-Brodhun screen and accessories for the photometry of arc and incandescent lamps.

This room also contains a ballistic set for the measurement of the magnetic properties of iron and the magnetic leakage of dynamos, and a complete set of cable testing apparatus.

Switch Boards. By means of the four inter-connected switch boards and numerous circuits connecting these switch boards with the different parts of the several rooms, the use of temporary connections is reduced to a minimum.

Regulations.

Attention is called to several regulations which affect the order of studies.

Those students of Electrical and Mechanical Engineering who enter the School with one or more conditions are required to take the workshop courses during the Summer. This plan is designed to reduce the amount of work during the school year, and to give students who need it more time for the severer mental application.

Most of the subjects given in the School are necessarily arranged in sequence, and students are required to make satisfactory records at each stage of their progress in order to obtain further advancement. As there are many sequences of this kind, the student will do well to read, in the description of courses, the notes under the several subjects.

Students receive credit for all advanced studies passed at the entrance examination. It will be found advantageous to prepare in the mathematics of the first year before entering the School.

Admission conditions in Mathematics must be made good at the end of the first year, and admission conditions in other subjects by the end of the second year.

Relation to the University.

The connection of the courses in Engineering with the University is of great value to students on account of the scholarly atmosphere and the broad field of study in which they find themselves. The increasing competition in professional work which awaits the graduates from year to year, demands constantly higher attainments and greater care in deciding upon their life occupations. For this reason, the similarity of the first two years in all the courses has a decided value in affording the young student time to think about his career.

Students who have registered in the College may devote a part of their time to those studies in Engineering which count towards the degree of A.B. and one of the four years required for that degree may be spent in the Scientific School, into which they may transfer at the end of the third year. Two years in the Scientific School, in addition to three in the College, will usually suffice for the special study of Engineering, and enable a student to obtain the S.B. degree. He may thus obtain both the College and the Scientific School degrees by five years of study. This method of taking the courses possesses many advantages, and all young men who

have the time to spare are strongly advised to follow it. By the superior equipment thus obtained, they cannot fail to make good within a short time after graduation the extra year thus given to study.

SUMMER COURSES.

The courses in Surveying and Railroad Engineering are continued for seven weeks into the Summers of the first and second years. This work is required of all students of Civil Engineering. It affords practice in the field in making actual surveys, the entire time being taken up in practical methods. Certain tracts of land bordering on the coast are surveyed and topographical maps are made to scale. Several miles of railroad are projected and surveyed and the drawings and estimates prepared for the construction of the road.

The workshop courses *must* be taken during the Summer by students who have conditions or deficiencies, and they *may* be so taken by any students, in classes made up as soon as possible after the final examinations. All students are advised to take this work in the Summer, when the time can be given entirely to it, instead of during the school year. The classes are arranged in sections, and from six to seven hours daily for five weeks will enable a student to complete two courses.

Method of Instruction.

The method of instruction is that of lectures and conferences, supplemented by recitations and laboratory work. Laboratory practice with the testing machine, steam engine, dynamo, motor, power and hand tools and other machines is given at certain stages of instruction. Field-work with surveying and geodetic instruments is made a prominent feature of the course. Visits of inspection and observation are made to engineering works in process of construction and operation.

Lectures are given before the Harvard Engineering Society at intervals during the year by engineers engaged in the active practice of their professions. These lectures are open to all students of Engineering.

The aim of the Mathematical courses is, so far as possible, to present the essentials of the various subjects from the point of view of the student of Applied Mathematics. Instruction is given by lectures, by assigned reading, by blackboard drill, and by individual conferences. Written recitations occupying a part or the whole of the hour are given frequently. Special meetings of sections of the classes are held when desirable, for the purpose of guiding students in their study of the more difficult problems.

Civil and Topographical Engineering.

The student's attention is called to the requirement of seven weeks' work in the field, at the end of each of the first two years; this work is a continuation of the courses in surveying and railroad engineering.

Students who complete this course, pass the required examinations and present a satisfactory thesis will receive the degree of Bachelor of Science in Civil and Topographical Engineering.

First Year.

Algebra (Engineering 1*a*).
Mon., Wed., Fri., at 10. First half-year. (II)

Trigonometry (Engineering 1*b*).
Tu., Th., at 10. First half-year. (VIII)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (II)

Mechanical Drawing (Engineering 3*a*).
I, *Mon., at 1 30;* draughting, *Mon., Fri., 1.30–4.30:* II, *Tu., at 1.30;* draughting, *Tu., Th., 1.30–4.30.* (XIII)

Land Surveying (Engineering 4*a*).
Tu., Th., 1.30–4 30. Second half-year and seven weeks in the summer. (XIV)

General Descriptive Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Wed., 1.30–4.30.* (IV)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (X)

German or French. One ful. course in addition to the admission requirements, so chosen as not to conflict with the other prescribed courses.

Second Year.

Solid Analytic Geometry, Differential and Integral Calculus (Engineering 1*c*).
Tu., Th., Sat., at 11, and during the first half-year, Wed., at 11. (IX)

Descriptive Geometry (Engineering 3*b*).
Mon., Fri., at 11; draughting, *six hours a week:* I, *Mon., Fri., 1.30-4.30;* II, *Tu., Th., 1.30-4.30. First half-year.* (III)

Mechanism (Engineering 3*d*).
Mon., Fri., at 11. draughting, *four hours a week.* I, *Mon., Fri., 1.30-3.30;* II, *Tu., Th., 1.30-3.30. Second half-year.* (III)

Stereotomy (Engineering 3*e*).
Wed., at 11; draughting, *six hours a week.* I, *Mon., Fri., 1.30–4.30;* II, *Tu., Th., 1.30–4.30. Second half-year.* (XIV)

Geodesy (Engineering 4*c*).
Three weeks in the summer. (XIV)

Railroad Engineering (Engineering 4*d*).
Mon., Fri., 1.30–4.30. Second half-year and four weeks in the summer. (XIII)

General Descriptive Physics (Physics 1).
Tu., Sat., at 10; and laboratory work (*two hours a week, Tu., Wed., Th., or Fri.*). (VIII)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (XIII)

German or French. One full course so chosen as not to conflict with the other prescribed courses.

THIRD YEAR.

Analytic and Applied Mechanics (Engineering 5*a*).
Mon., Wed., Fri., at 11. (III)

Hydraulics (Engineering 6*a*).
Mon., Wed., Fri., at 10. Second half-year. (II)

Experimental Methods (Engineering 13*a*).
Sat., at 11; laboratory work, *three hours a week.*

Machinery and Boilers (Engineering 11*a*).
Mon., Wed., Fri., at 9, and Wed. afternoon. (I)

Masonry and Foundations (Engineering 8*a*).
Tu., Th., Sat., at 10. Second half-year. (VIII)

Metallurgy (Engineering 18*a*).
Tu., Th., Sat., at 12. First half-year. (X)

Common Roads (Engineering 4*e*).
Tu., Th., Sat., at 9. First half-year. (VII)

Elementary Geology (Geology 4).
Wed., Fri., and occasionally Mon., at 12. (IV)

Elementary Field and Laboratory Geology (Geology 5).
Laboratory work (*two hours, twice a week, in February and March*); Section A, *Tu., Th., 11–1;* or B, *Tu., Th., 2.30–4.30;* or C, *Wed., Fri., 2.30–4.30;* (*in April and May*) field-work, *Th. or Fri.* (*one half-day a week*); and laboratory work *Tu. or Wed.* (IV)

Optional.

Calculus (second course) (Engineering 1*f*).
Mon., Wed., Fri., at 12. First half-year. (IV)

FOURTH YEAR.

Bridges and Buildings (Engineering 7*a*).
Mon., Wed., Fri., 1.30–4.30. (XIII)

Resistance of Materials (Engineering 5*c*).
Tu., Th., Sat., at 11; laboratory work, ***three hours a week.*** *First half-year.* (IX)

Sanitary Engineering (Engineering 6*c*).
Tu., Th., Sat., at 9. First half-year. (VII)

Canals, Rivers, and Irrigation (Engineering 6*d*).
Tu., Th., Sat., at 9; laboratory work, ***six hours a week.*** *Second half-year.* (VII)

Continuous and Alternating Current Dynamo Electric Machinery (Engineering 16*c* and 16*e*).
16*c*. *Tu., Th., Sat., at 10;* laboratory work, ***six hours a week.*** *First half-year.*
16*e*. *Tu., Th., Sat., at 10;* laboratory work, ***six hours a week.*** *Second half-year.* (VIII)

Contracts and Specifications (Engineering 22).
Sat., at 12. Second half-year. (X)

Economics of Machinery (Engineering 21).
Mon., 11–1.

Preparation of Thesis.

Electrical Engineering.

The student's attention is called to the shopwork, a large part of which may be satisfied by five weeks' Summer work at the end of each of the first two years.

Students who complete this course, pass the required examinations and present a satisfactory thesis, will receive the degree of Bachelor of Science in Electrical Engineering.

An additional year is provided for those who wish to make an extended study of the mathematical theory of Electricity.

FIRST YEAR.

Algebra (Engineering 1*a*).
Mon., Wed., Fri., at 10. First half-year. (II)

Trigonometry (Engineering 1*b*).
Tu., Th., at 10. First half-year. (VIII)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (II)

Mechanical Drawing (Engineering 3*a*).
I, *Mon., at 1.30;* draughting, *Mon., Fri., 1.30–4.30:* II, *Tu., at 1.30;* draughting, *Tu., Th., 1.30–4.30.* (XIII)

Shopwork. — Use of Tools (Engineering 10*a*).
Lectures and laboratory work, *six hours a week for a half-year.* (XIV)

Shopwork. — Blacksmithing (Engineering 10*b*).
Lectures and laboratory work, *six hours a week for a half-year.* (XIV)

General Descriptive Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Wed., 1.30–4.30.* (IV)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (X)

German or French. One full course in addition to the admission requirements, so chosen as not to conflict with the other prescribed courses.

SECOND YEAR.

Solid Analytic Geometry. —. Differential and Integral Calculus (Engineering 1*c*).
Tu., Th., Sat., at 11, and during the first half-year, Wed. at 11. (IX)

Descriptive Geometry (Engineering 3*b*).
Mon., Fri., at 11; draughting, *six hours a week:* I, *Mon., Fri., 1.30–4.30;* II, *Tu., Th., 1.30–4.30. First half-year.* (III)

Mechanism (Engineering 3*d*).
Mon., Fri., at 11; draughting, *four hours a week.* I, *Mon., Fri., 1.30–3.30;* II, *Tu., Th., 1.30–3.30. Second half-year.* (III)

Shopwork. — Pattern Making and Foundry Practice (Engineering 10*c*).
Lectures and laboratory work, *six hours a week for a half-year.* (XIII)

Shopwork. — Machine Tools (Engineering 10*e*).
Lectures and laboratory work, *six to nine hours a week for a half-year.* (XIII)

Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th. afternoons.* (XIII)

Or General Descriptive Physics (Physics 1).
Tu., Sat., at 10; laboratory work, (*two hours a week, Tu., Wed., Th., or Fri.*). (VIII)

English Composition (English *BC*).
Wed., at 1 30, and a second hour at the pleasure of the instructors. (XIII)

German or French. One full course so chosen as not to conflict with the other prescribed courses.

THIRD YEAR.

Analytic and Applied Mechanics (Engineering 5*a*).
Mon., Wed., Fri., at 11. (III)

Continuous and Alternating Current Dynamo Electric Machinery (Engineering 16*c* and 16*e*).
16*c*. *Tu., Th., Sat., at 10;* laboratory work, *six hours a week. First half-year.*
16*e*. *Tu., Th., Sat., at 10;* laboratory work, *six hours a week. Second half-year.* (VIII)

Machinery and Boilers (Engineering 11*a*).
Mon., Wed., Fri., at 9, and Wed. afternoon. (I)

Hydraulics (Engineering 6*a*).
Mon., Wed., Fri., at 10. Second half-year. (II)

Experimental Methods (Engineering 13*a*).
Sat., at 11; laboratory work, *three hours a week.*

Metallurgy (Engineering 18*a*).
Tu., Th., Sat., at 12. First half-year. (X)

Optional.

Calculus (second course) (Engineering 1*f*).
Mon., Wed., Fri., at 12. First half-year. (IV)

FOURTH YEAR.

Resistance of Materials (Engineering 5*c*).
Tu., Th., Sat., at 11; laboratory work, *three hours a week. First half-year.* (IX)

Dynamo Electric Machinery (second course) (Engineering 16*d*).
Fri., at 9; laboratory work, *eight hours a week.* (I)

Electrical Transmission and Distribution of Power (Engineering 17*a*).
Tu., Th., at 11. Visits to power stations. Second half-year. (IX)

Economics of Steam (Engineering 12*a*).
Tu., Th., Sat., at 9. First half-year. (VII)

Electrostatics, Electrokinematics, and Electromagnetism (Physics 3).
Tu., at 12; laboratory work, *six to eight hours a week. Second half-year.* (X)

Electrodynamics and Electromagnetism (Physics 4).
Tu., Th., at 10, and laboratory work. *First half-year.* (VIII)

Machine Design (Engineering 14*a*).
Tu., Th., 1.30–4.30. (XIV)

Contracts and Specifications (Engineering 22).
Sat., at 12. Second half-year. (X)

Economics of Machinery (Engineering 21).
Mon., 11–1.

Preparation of Thesis.

Advanced Course in Electrical Engineering.

The following advanced course is provided for those students who wish to continue their studies a year beyond the regular course. The additional year is devoted, for the most part, to the study of mathematics and the mathematical theory of electricity; but additional time is also available for advanced experimental work and for preparation of the thesis.

Third Year.

Differential and Integral Calculus (second course) (Mathematics 5).
Mon., Wed., Fri., at 11. (III)

Taken in addition to courses already provided in the third year.

Fourth Year.

Trigonometric Series. — Spherical Harmonics (Mathematics 10).
Tu., Th., Sat., at 12. (X)

Taken in addition to courses already provided in the fourth year.

Fifth Year.

Portions of the Mathematical Theory of Electricity and Magnetism (Physics 9).
Tu., Fri., at 11, and a third hour at the pleasure of the instructor. (IX)

Electrodynamics (Physics 8).
Laboratory work, *nine hours a week.*

Laboratory Work and Thesis.

Mechanical Engineering.

The student's attention is called to the shopwork, a large part of which may be satisfied by five weeks' Summer work at the end of the first and second years.

Students who complete this course, pass the examinations, and present a satisfactory thesis will receive the degree of Bachelor of Science in Mechanical Engineering.

First Year.

Algebra (Engineering 1*a*).
Mon., Wed., Fri., at 10. First half-year. **(II)**

Trigonometry (Engineering 1*b*).
Tu., Th., at 10. First half-year. **(VIII)**

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. **(II)**

Mechanical Drawing (Engineering 3*a*).
I, ***Mon., at 1.30;*** draughting, ***Mon., Fri., 1.30–4.30:*** II, ***Tu., at 1.30;*** draughting, ***Tu., Th., 1.30–4.30.*** **(XIII)**

Shopwork. — Use of Tools (Engineering 10*a*).
Lectures and laboratory work, ***six hours a week for a half-year.*** **(XIV)**

Shopwork. — Blacksmithing (Engineering 10*b*).
Lectures and laboratory work, ***six hours a week for a half-year.*** **(XIV)**

General Descriptive Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, ***Wed., 1.30–4.30.*** **(IV)**

Rhetoric and English Composition (English *A*).
Divided into sections. I, ***Mon., Wed., Fri., at 10;*** II, ***Mon., Wed., Fri., at 11;*** III, ***Mon., Wed., Fri., at 12;*** IV, ***Tu., Th., Sat., at 10;*** V, ***Tu., Th., Sat., at 11;*** VI, ***Tu., Th., Sat., at 12.*** **(X)**

German or French. One full course in addition to the admission requirements, so chosen as not to conflict with the other prescribed courses.

Second Year.

Solid Analytic Geometry, Differential and Integral Calculus (Engineering 1*c*).
Tu., Th., Sat., at 11, and during the first half-year, Wed., at 11. **(IX)**

Descriptive Geometry (Engineering 3*b*).
Mon., Fri., at 11; draughting, ***six hours a week;*** I, ***Mon., Fri., 1.30–4.30;*** II, ***Tu., Th., 1.30–4.30. First half-year.*** **(III)**

Mechanism (Engineering 3*d*).
Mon., Fri., at 11; draughting, *four hours a week.* I, *Mon., Fri., 1.30–3.30;* II, *Tu., Th., 1.30–3.30. Second half-year.* (III)

Shopwork. — Pattern Making and Foundry Practice (Engineering 10*c*).
Lectures and laboratory work, *six hours a week for a half-year.* (XIII)

Shopwork. — Machine Tools (Engineering 10*e*).
Lectures and laboratory work, *six to nine hours a week for a half-year.* (XIII)

General Descriptive Physics (Physics 1).
Tu., Sat., at 10; and laboratory work (*two hours a week, Tu., Wed., Th., or Fri.*). (VIII)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (XIII)

German or French. One full course so chosen as not to conflict with the other prescribed courses.

THIRD YEAR.

Analytic and Applied Mechanics (Engineering 5*a*).
Mon., Wed., Fri., at 11. (III)

Machinery and Boilers (Engineering 11*a*).
Mon., Wed., Fri., at 9, and Wed. afternoon. (I)

Steam Engines and Boilers. — Details (Engineering 11*b*).
Tu., Th., Sat., at 9. Second half-year. (II)

Hydraulics (Engineering 6*a*).
Mon., Wed., Fri., at 10. Second half-year. (II)

Experimental Methods (Engineering 13*a*).
Sat., at 11; laboratory work, *three hours a week.*

Machine Design (Engineering 14*a*).
Tu., Th., 1.30–4.30. (XIV

Metallurgy (Engineering 18*a*).
Tu., Th., Sat., at 12. First half-year. (X)

Optional.

Calculus (second course) (Engineering 1*f*).
Mon., Wed., Fri., at 12. First half-year. (IV)

FOURTH YEAR.

Resistance of Materials (Engineering 5*c*).
Tu., Th., Sat., at 11; laboratory work, *three hours a week. First half-year.* (IX)

Engineering Laboratory (Engineering 13*b*).
Mon., at 10; laboratory, *nine hours a week.*

Machine Design (Engineering 14*b*).
Nine hours a week.

Continuous and Alternating Current Dynamo Electric Machinery (Engineering 16*c* and 16*e*).
16*c*. *Tu., Th., Sat., at 10;* laboratory work, *six hours a week. First half-year.*
16*e*. *Tu., Th, Sat., at 10;* laboratory work, *six hours a week. Second half-year.* (VIII)

Economics of Steam (Engineering 12*a*).
Tu., Th., Sat., at 9. First half-year. (VII)

Heating and Ventilation (Engineering 12*c*).
Tu., Th., Sat., at 11. Second half-year. (IX)

Contracts and Specifications (Engineering 22).
Sat., at 12. Second half-year. (X)

Economics of Machinery (Engineering 21).
Mon., 11-1.

Preparation of Thesis.

MINING AND METALLURGY.

The aim of this course is to provide a thorough preparation for professional work in Mining and Metallurgy by instruction in Mathematics, General Engineering, Mining, Metallurgy, Chemistry, Geology and Mineralogy, as well as in selected courses in Mechanical and Electrical Engineering. The mathematical work extends over the first three years. In the First-Year are included instruction in higher Algebra, Trigonometry, and Analytic Geometry. These are followed in the Second-Year by a course in Solid Analytic Geometry and Differential and Integral Calculus, and in the Third-Year by Analytic and Applied Mechanics. The mathematical work is especially planned for Engineering students, and the solution of problems is a prominent feature in all these courses.

In General Engineering, the work in Mechanical Drawing, including Descriptive Geometry, extends over two years; in Surveying, including Geodetic, Mining, Hydrographic and Railroad Surveying, the work also extends over the same period, and includes also field-work for portions of two summer vacations; courses in Hydraulics and Hydraulic Motors, Machinery and Boilers, and in Dynamo Electric Machinery each extend through a half-year. In the latter courses the resources of the engineering laboratories are fully utilized for the purposes of demonstration and experiment, and visits of inspection are made to the numerous pumping, power and hydraulic plants within easy access of the School.

The work in Mining and Metallurgy occupies a considerable portion of the student's time in the third and fourth years. In the Third-Year a half-course is devoted to the subjects of Prospecting, Exploring, Sampling, etc., with a general outline of mining operations, in order that the student may intelligently pursue his practical work in the following summer. Two half-courses are devoted to a systematic description of metallurgical processes. In all these courses the collections of the department of maps, specimens and photographs are constantly used. Excursions are made during the term and short vacations to points of mining and metallurgical interest. In the Fourth-Year systematic courses are given in Mining and Ore-dressing.

In Chemistry the work extends over four years. In the First-Year is placed the course in Descriptive Inorganic Chemistry, which deals with the preparation, properties and uses of the principal elements and inorganic compounds. In this course four hours' work in the laboratory each week is required during the year. It is followed in the Second-Year by Qualitative Analysis and in the Third-Year by Quantitative Analysis, each of which consists chiefly of laboratory work for at least nine hours a week throughout the year. These three courses are given in the thoroughly equipped laboratories of Boylston Hall. In the Fourth-Year the chemical work consists of practice in the analysis of ores, metals, slags, fuels, and refractory materials, and also includes fire-essaying. The main object of this course is to teach the student to work rapidly, as well as accurately.

The work in Geology and Mineralogy begins in the Second-Year with the elementary courses in these subjects. The courses in Geology include both a systematic outline of the science, and also laboratory study of illustrative specimens, photographs, maps, models, etc., with a considerable amount of practical work in the field. In Mineralogy, besides the descriptive lectures, six hours a week throughout the year are devoted to the determination of minerals by their crystal-form and other physical properties, and by blow-pipe and chemical tests. In the Third-Year the geological work consists in the study of ore-deposits, in which the more important occurrences of the ores of the principal metals are described in their geographical and economic relations. A large collection of maps, specimens, and photographs are studied in connection with this course. In the Fourth-Year, Economical Geology is continued in reference to the non-metalliferous minerals; full courses also are given in Petrography, with laboratory work; in independent geological field-work; and in writing reports.

Supplementary to the instruction given during term-time at the University, the student is required to pursue, in each of the three summer vacations occurring during his residence, a systematic plan of field-work, under the guidance of the teachers of the School. In the first summer

the student's time will be devoted to general surveying, in order that he may become expert in the use of instruments, and able to work independently. In the second summer the field-work for three or four weeks will consist of practice in mine-surveying, and in plotting the notes of such surveys. The student will then give an additional six weeks to geological field-study, during which time he should acquire a general knowledge of sedimentary and igneous rocks, and of their structural features.

In the third summer the student is required to spend from eight to ten weeks in one or more mining districts. His work will include an investigation into the geological relations and occurrence of the mineral deposits of the district, and the systems of mining by which they are exploited: a detailed description and criticism will be required of the methods of mining which are there exhibited, including the details of stopping, underground transportation, hoisting, pumping, treatment of the ores, etc. In this work the student will be required to take extended notes, and to prepare a written report at the end of the season.

Persons who faithfully pursue these courses should be qualified at graduation to begin the practice of their profession. They should be particularly well prepared in general and applied geology, and in chemistry.

The examinations for admission are the same as those required for the other departments of the School. Candidates for admission are, however, advised to offer both French and German, and Experimental Physics.

Students in Harvard College who intend after graduation to take this course, are advised, as far as possible, to anticipate the elementary work as above noted in Mathematics, Engineering, Geology, and Chemistry.

Persons who satisfactorily complete this programme and present an acceptable thesis receive the degree of Bachelor of Science in Mining and Metallurgy.

First Year.

Algebra (Engineering 1*a*).
Mon., Wed., Fri., at 10. First half-year. (II)

Trigonometry (Engineering 1*b*).
Tu., Th., at 10. First half-year. (VIII)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (II)

Mechanical Drawing (Engineering 3*a*).
I, *Mon., at 1.30;* draughting, *Mon., Fri., 1.30–4.30:* II, *Tu., at 1.30;* draughting, *Tu., Th., 1.30–4.30.* (XIII)

Land Surveying (Engineering 4*a*).
Tu., Th., 1.30–4.30. Second half-year and seven weeks in the summer. (XIV)

General Descriptive Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Wed., 1.30–4.30.* (IV)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (X)

Elementary German (German *A*).
Mon., Wed., Fri., at 9. (XII)
Required of students who did not offer German for admission.

Or Elementary French (French *A*).
Mon., Wed., Fri., at 9. (XII)
Required of students who did not offer French for admission.

SECOND YEAR.

Solid Analytic Geometry. — Differential and Integral Calculus (Engineering 1*c*).
Tu., Th., Sat., at 11, and during the first half-year, Wed., at 11. (IX)

Railroad Engineering (Engineering 4*d*).
Mon., Fri., 1.30–4.30. Second half-year and four weeks in the summer. (XIII)

General Descriptive Physics (Physics 1).
Tu., Sat., at 10; laboratory work, (*two hours a week, Tu., Th., Fri.*). (VIII)

Qualitative Analysis (Chemistry 3).
Mon., Wed., Fri., at 11; laboratory work, *nine hours a week.* (III)

Mineralogy (Mineralogy 2).
Mon., Wed., Fri., at 10; laboratory work, *six hours a week.* (II)

Elementary Geology (Geology 4).
Wed., Fri., and occasionally Mon. at 12. (IV)

Field and Laboratory Geology (Geology 5).
Laboratory work (*two hours, twice a week, in February and March*); Section A, *Tu., Th., 11–1;* or B, *Tu., Th., 2.30–4.30;* or C, *Wed., Fri., 2.30–4.30;* (*in April and May*) field work, *Th. or Fri.* (*one half day a week*); and laboratory work, *Tu. or Wed.* (IV)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at pleasure of the instructors. (XIII)

THIRD YEAR.

Prospecting and Exploring (Mining 1).
Tu., Th., Sat., at 12. Second half-year. (X)

Metallurgy of iron and steel, copper and nickel (Metallurgy 2).
Mon., Wed., Fri., at 12. First half-year. (IV)

Metallurgy of lead, zinc, gold, silver and the minor metals (Metallurgy 3).
Mon., Wed., Fri., at 12. Second half-year. (IV)

Mining Geology (Geology 10).
Tu., Th., Sat., at 10. (VIII)

Analytic and Applied Mechanics (Engineering 5*a*).
Mon., Wed., Fri., at 11. (III)

Hydraulics (Engineering 6*a*).
Mon., Wed., Fri., at 10. Second half-year. (II)

Machinery and Boilers (Engineering 11*a*).
Mon., Wed., Fri., at 9, and Wednesday afternoon. (I)

Quantitative Analysis (Chemistry 4).
Mon., Wed., Fri., at 3.30; laboratory work, ***nine hours a week.***
(VI)

FOURTH YEAR.

Metal and Coal Mining (Mining 5).
Mon., Wed., Fri., at 10. (II)

Metallurgical Chemistry (Metallurgy 6).
Mon., Wed., Fri., at 2.30, with additional laboratory hours. (V)

Economical Geology (Geology 18).
Wed., Fri., and (at the pleasure of the instructor) Mon., at 4.30. First half-year.

Geological Investigation in the Field and Laboratory (Geology 22*b*). Professor SHALER and other instructors.

Petrography (Mineralogy 12).
Tu., Th., at 11, and an occasional third hour, with additional laboratory hours. (IX)

Continuous and Alternating Current Dynamo Electric Machinery (Engineering 16*c* and 16*e*).

16*c*. *Tu., Th., Sat., at 10;* laboratory work, ***six hours a week.*** *First half-year.*

16*e*. *Tu., Th., Sat., at 10;* laboratory work, ***six hours a week.*** *Second half-year.* (VIII)

ARCHITECTURE.

The following schedule sets forth the studies required of those persons who are candidates for the degree of S.B. in Architecture. By anticipating any of these subjects at the admission examination or by passing in the equivalent course in the Summer School, students gain additional time to devote to the strictly professional studies. The course is arranged to be completed in four years, but students are advised to take five years unless they enter the school very well prepared.

Candidates for admission who intend to pursue this course are advised to offer the History of Greece and Rome in the examination for admission. It is desirable that he should have attained some proficiency in free-hand drawing before examination.

Students will receive credit for all advanced studies passed at the admission examination. It will be found advantageous to prepare in both French and German before entering.

Students who complete this course and present a satisfactory thesis will receive the degree of S.B. in Architecture.

The department of Architecture has the great advantage of being closely allied to the department of Fine Arts of Harvard College, and, through the intimate connection of the Lawrence Scientific School with the Academic department (both of which are united under the Faculty of Arts and Sciences), of being able to draw upon the College courses as far as may be desirable. On the other hand the Scientific School itself affords the solid basis of practical training upon which the study of architecture as a profession must rest.

The instruction offered in this department is intended to afford the preliminary technical training required for the practice of Architecture. As all such school training must be supplemented by practical experience in an architect's office, students are advised during their period of study to devote a portion of their summer vacation to that work. In grouping the courses it has been recognized that Architecture is essentially a Fine Art, the practice of which must be based on a thorough knowledge of Construction. Great stress has therefore been laid on continued practice in design and drawing and thorough instruction in the history and principles of the Fine Art of Architecture and the arts allied with it. Such knowledge as can be better and more rapidly acquired by actual office experience will only be touched upon in a general way in order to leave more time for subjects which can be adequately taught only in an architectural school. The course is so arranged that professional studies begin in the First-Year and are continued through four years. In the

First-Year the History of Ancient Architecture is taken up in such a way as to give the student a familiarity with classic form which shall serve as a basis for the subsequent practice in original Design which continues through the whole of the following three years. The aim is to give students such a knowledge of the history of architecture and of the growth and meaning of architectural forms as may enable them ultimately to use precedent not blindly, but intelligently and with some freedom. The History of Architecture (with practice in drawing its various forms) is continued through the Second-Year and completed in the Third. Courses are included in the general history of the Fine Arts which enable the student to understand the relation of architecture to the other arts and the relation of the art of different periods to their social and political life, without which knowledge the architect is not likely to use the forms of his art in an intelligent and scholarly manner.

With regard to Construction, a thorough and broad general knowledge of principles and their application to modern work will be insisted upon rather than a minute consideration of constructive details. So much of Mathematics is taught as is necessary to this knowledge and to the exigencies of actual office practice. The mathematics required is completed in the First-Year. In the Second-Year Mechanics and Strength of Materials is taken up, and Building Construction in the Third. In the Third and Fourth years lectures will be given on Professional Practice, Heating and Ventilation and Sanitary Engineering. Students are advised to take the summer course in Surveying during some part of their course.

The latter half of the Fourth-Year is devoted to the preparation of a Thesis. The subject of this thesis must be decided upon in consultation with the instructors of the department at the beginning of the year. The thesis may consist of either (1) an original design for some architectural work, or (2) a series of drawings illustrative of some important architectural monument of the past. In either case it must be accompanied by a written essay considering the design, or the monument, aesthetically and in the second case historically. The essay must also consider the constructive principles involved in the design, and give calculations concerning the more important structural parts.

The department possesses a good collection of architectural casts, photographs, and drawings, which will be added to from time to time. In addition to this, the collections of the Fine Arts department in the Fogg Art Museum of the University, consisting of casts, photographs, diagrams, and drawings, and the casts and photographs of Assyrian, Persian, and Roman work in the Semitic collection in the Peabody Museum, are available and are always open to students.

The University Library at Gore Hall contains a very complete collection of books on Architecture and the Fine Arts, and the department itself

possesses a carefully selected working library, which is placed in a room adjoining the architectural drawing-room, where books may be freely consulted by students.

The drawing-room is open to students from 9 A.M. to 9 P.M., and an instructor will usually be present from 9 A.M. to 4 P.M.

Facilities will be given for graduate work in Architecture, and students who can do so are advised to extend their period of school training by one or more years of graduate study. The four years that has been allotted usually, in this country, to such training, is a much shorter time than is given in the great schools of art in Europe, or than might with advantage be devoted to academic training in architecture.

The courses in Architecture have been arranged primarily to meet the needs of students in the Scientific School, who are taking the technical four years' course. All of these courses are open also to students in the College who are fitted to profit by them, and the courses on the History of Architecture (1*a*, 1*b*, 1*c*) may be counted for the degree of A.B.

Students in the College intending, after graduation, to take up the study of Architecture professionally, are advised to arrange their college course in such a way as to provide a foundation for their professional studies. Besides taking the courses in Fine Arts, such students are recommended to study the History of Greece and Rome, the Middle Ages, and the Renaissance. They might also, with advantage, take such courses in Classical Philology as have a bearing on the History of Art, and it is important that they should acquire a knowledge of French and German, as the best works on architecture are in these languages. Some mathematical courses should also form part of such a plan of general education intended to serve as a foundation for the subsequent technical study of architecture. The mathematics required in the four years' course in architecture might in this way be anticipated. The instructors in architecture will be glad to advise with students who intend to plan such a course.

If the college course is carefully planned with that end in view, it will be possible to graduate in architecture in three years after taking the academic degree, or even in two years, although this is not advised.

The work of the architect requires not only a technical knowledge of building processes and familiarity with architectural form, its history and use, but it demands wide intellectual sympathy, cultivated taste, and trained imagination. Such training and cultivation can most readily be obtained — or the impulse leading to it can best be given — by a carefully arranged college course. Those who intend to pursue architecture as a profession are therefore strongly advised to take, if possible, a full college course before beginning their technical studies.

First Year.

Technical and Historical Development of the Ancient Styles (Architecture 1*a*).
Mon., Wed., Fri., at 12, and additional hours for drawing. (IV)

Elementary Architectural Drawing (Architecture 2*a*).
At least 12 hours a week. (XII)

Principles of Delineation and Freehand Drawing (Fine Arts 1).
Mon., Wed., Fri., at 2.30, and additional hours for drawing. (V)

Algebra (Engineering 1*a*).
Mon., Wed., Fri., at 10. First half-year. (II)

Trigonometry (Engineering 1*b*).
Tu., Th., at 10. First half-year. (VIII)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (II)

Rhetoric and English Composition (English *A*).
Divided in sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (X)

Elementary German (German *A*).
Mon., Wed., Fri., at 9. (XII)
Required of students who did not offer German for admission.

Or Elementary French (French *A*).
Mon., Wed., Fri., at 9. (XII)
Required of students who did not offer French for admission.

Second Year.

Freehand Drawing from Architectural Subjects (Architecture 3*a*).
Two sections. I, *Mon., Wed., Fri., at 9, and three other hours;* II, *Tu., Th., Sat., at 9, and three other hours.*

†Technical and Historical Development of the Mediaeval Styles (Architecture 1*b*).
Mon., Wed., Fri., at 10. (II)

Or †Technical and Historical Development of the Renaissance and Modern Styles (Architecture 1*c*).
Mon., Wed., at 10, and a third hour at the pleasure of the instructor. (II)

† Architecture 1*b* and Architecture 1*c* are given in alternate years.

Elementary Architectural Design (Architecture 4*a*).
Tu., Th., 2.30-4 30, and additional hours for drawing. (XI)

Elementary Statics (Engineering 5*b*).
Tu., Th., Sat., 10-12. First half-year. (IX)

Elementary Structural Design (Engineering 5*d*).
Tu., Th., Sat., 11-1. Second half-year. (X)

Descriptive Geometry. — Elementary Shades. — Shades and Perspective (Engineering 3*b*).
Lectures, *Mon., Fri., at 11;* draughting, *six hours a week:* I, *Mon., Fri., 1.30-4.30;* II, *Tu., Th., 1.30-4.30. First half-year.* (III)

Stereotomy, Shades, Shadows, and Perspective (Engineering 3*e*).
Lectures, *Wed., at 11;* draughting, *six hours a week:* I, *Mon., Fri., 1.30-4.30;* II, *Tu., Th., 1.30-4.30. Second half-year.* (XIV)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (XIII)

Advanced German (German 1*c*).
Tu., Th., Sat., at 9. (VII)

Or Advanced French (French 1*b*).
Mon., Wed., Fri., at 9. (IX)

THIRD YEAR.

Freehand Drawing from Architectural Subjects (Architecture 8*b*).
Mon., Wed., Fri., at 9, and three other hours. (I)

†Technical and Historical Development of the Mediaeval Styles (Architecture 1*b*).
Mon., Wed., Fri., at 10. (II)

Or †Technical and Historical Development of the Renaissance and Modern Styles (Architecture 1*c*).
Mon., Wed., at 10, and a third hour at the pleasure of the instructor. (II)

Architectural Design (second course) (Architecture 4*b*).
Tu., Th., 2 30-4.30, and additional hours for drawing. (XI)

Masonry and Foundations (Engineering 8*a*).
Tu., Th., Sat., at 10. Second half-year. (VIII)

Building Construction. — Carpentry. Lectures and drawing (Architecture 5).
Tu., Th., 2.30-4.30. First half-year. (XII)

† These courses are given in alternate years.

History of Greek Art (Fine Arts 3).
Tu., Th., Sat., at 9. (VII)

Or †The Fine Arts of the Middle Ages and of the Renaissance (Fine Arts 4).
Tu., Th., Sat., at 9. (I)

†Private Life of the Greeks as illustrated by Works of Art (Greek 10).
Tu., Th., and (at the pleasure of the instructor) Sat., at 12. (X)

Or †Private Life of the Romans as illustrated by Works of Art (Latin 10).
Tu., Th., Sat., at 12. (X)

FOURTH YEAR.

Freehand Drawing from Architectural Subjects (Architecture 3*c*).
Mon., Wed., at 9, and four other hours. First half-year. (I)

Architectural Design (advanced course) (Architecture 4*c*). (XI)

Modelling (Architecture 6).
Fri., 1.30–4.30. (VI)

†History of Greek Art (Fine Arts 3).
Tu., Th., Sat., at 9. (VII)

Or †The Fine Arts of the Middle Ages and of the Renaissance (Fine Arts 4).
Tu., Th., Sat., at 9. (I)

†Private Life of the Romans as illustrated by Works of Art (Latin 10).
Tu., Th., Sat., at 12. (X)

Or †Private Life of the Greeks as illustrated by Works of Art (Greek 10).
Tu., Th., and (at the pleasure of the instructor) Sat., at 12. (X)

Geology and Mineralogy of Building Stones (Mineralogy 3).
Wed., at 1.30. First half-year.

Contracts and Specifications (Engineering 22).
Sat., at 12. Second half-year. (X)

Thesis.

CHEMISTRY.

This course of study is intended for students preparing to become practical chemists or teachers of the science.

Students who complete this course, pass the required examinations, and present a satisfactory thesis receive the degree of Bachelor of Science in Chemistry.

† These courses are given in alternate years.

FIRST YEAR.

General Descriptive Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30, or Wed., Fri., 2.30–4.30.* (IV)

Algebra (Engineering 1*a*).
Mon., Wed., Fri., at 10. First half-year. (II)

Trigonometry (Engineering 1*b*).
Tu., Th., at 10. First half-year. (VIII)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (II)

Mechanical Drawing (Engineering 3*a*).
I, *Mon., at 1.30;* draughting, *Mon., Fri., 1.30–4.30:* II, *Tu., at 1.30;* draughting, *Tu., Th., 1.30–4.30.* (XIII)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (X)

Elementary German (German *A*).
Mon., Wed., Fri., at 9. (XII)
Required of students who did not offer German for admission.

Or Elementary French (French *A*).
Mon., Wed., Fri., at 9. (XII)
Required of students who did not offer French for admission.

SECOND YEAR.

Qualitative Analysis (Chemistry 3).
Mon., Wed., Fri., at 11; laboratory work, *nine hours a week.* (III)

Quantitative Analysis (Chemistry 4).
Mon., Wed., Fri., at 3.30; laboratory work, *nine hours a week.* (VI)

Mineralogy (Mineralogy 2).
Mon., Wed., Fri., at 10, and additional laboratory hours. (II)

Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* Sections will be arranged for *Mon., Tu., Wed., and Th. afternoons.* (XIII)

Or General Descriptive Physics (Physics 1).
Tu., Sat., at 10; laboratory work (*two hours a week, Tu., Wed., Th., or Fri.*). (VIII)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (XIII)

Advanced French (French 1*b*).
Mon., Wed., Fri., at 9. (IX)

THIRD YEAR.

Advanced Quantitative Analysis (Chemistry 9).
Mon., Wed., Fri., at 2.30; laboratory work, *nine hours a week. First half-year.* (V)

Gas Analysis (Chemistry 10).
Mon., Wed., Fri., at 2.30; laboratory work, *nine hours a week. Second half-year.* (V)

The Carbon Compounds (Chemistry 5).
Mon., Wed., Fri., at 9; laboratory work, *six hours a week.* (I)

Chemical Philosophy (Chemistry 8).
Tu., Th., at 12. Second half-year. (X)

Elementary Botany (Botany 1).
Tu., Th., at 10, and a third hour at the pleasure of the instructor. Laboratory work, *six hours a week*, in five sections: I, *Mon., Wed., Fri., 9–11;* II, *Mon., Wed., Fri., 11–1;* III, *Mon., Wed., Fri., 1.30 & 30;* IV, *Tu., Th., Sat., 11–1;* V, *Tu., Th., 1.30–3.30, and Sat., 9–11. Second half-year.* (VIII)

Elementary Zoölogy (Zoölogy 1).
Tu., Th., and (at the pleasure of the instructor) Sat., at 10. Laboratory work, *three hours a week*, in five sections: I, *Tu., 9–10 and 11–1;* II, *Tu., 1.30–4.30;* III, *Th., 9–10 and 11–1;* IV, *Th., 1.30–4.30;* V, *Sat., 9–10 and 11–1. First half-year.* (VIII)

Advanced German (German 1*c*).
Tu., Th., Sat., at 9. (VII)

FOURTH YEAR.

Physical Chemistry (Chemistry 6).
Wed., Fri., at 12; laboratory work, *Mon., at 12.* (IV)

Advanced study and research with preparation of a thesis (Chemistry 20), the equivalent of four courses.

GEOLOGY.

The studies in this Department are designed to furnish a special training for those who wish to prepare themselves for duty in Government Geological Surveys or for teaching. The studies may, on special application to the Administrative Board of the School, be varied to meet the

wants of individual students beyond the limits indicated in the programme. Those who make a good use of the opportunities afforded by the Summer Schools, held under the direction of the professors in the Department, may shorten the course of study to three years. All students are required to take o e of the advanced courses in Geology during one of their summer vacations. Students who design entering the School in the autumn of any year are advised to take the Summer Course in Elementary Geology, which is regarded as the equivalent of Geology 4.

Students who complete the above course and pass the required examinations receive the degree of Bachelor of Science in Geology.

FIRST YEAR.

Algebra (Engineering 1*a*).
Mon., Wed., Fri., at 10. First half-year. (II)

Trigonometry (Engineering 1*b*).
Tu., Th., at 10. First half-year. (VIII)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (II)

Mechanical Drawing (Engineering 3*a*).
I, *Mon., at 1.30;* draughting, *Mon., Fri., 1.30-4.30:* II, *Tu., at 1.30;* draughting, *Tu., Th., 1.30-4.30.* (XIII)

Land Surveying (Engineering 4*a*).
Tu., Th., 1.30-4.30. Second half-year and seven weeks in the summer. (XIV)

*Experimental Physics (Physics *B*).
Lectures (*Wed., at 12*) and laboratory work (*two hours a week*). (IV)

General Descriptive Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30-3.30,* or *Wed., Fri., 2.30-4.30.* (IV)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (X)

And one of the following courses if any of the above are offered for admission:—

Advanced French (French 1*b*).
Mon., Wed., Fri., at 9. (IX)

Or Advanced German (German 1*c*).
Tu., Th., Sat., at 9. (VII)

* Physics *B* may be omitted by those students who have passed in Experimental Physics for admission.

SECOND YEAR.

Descriptive Geometry (Engineering 3*b*).
Lectures, *Mon., Fri., at 11;* draughting, *six hours a week:* I, *Mon., Fri., 1.30-4.30;* II, *Tu., Th., 1.30-4.30.* (III)

Geodesy (Engineering 4*c*).
Three weeks in the summer, eight hours each week-day.

Elementary Physiography (Geography *A*).
Mon., Wed., Fri., at 10, a laboratory conference of one hour on Tu. between 9 and 12, and additional laboratory and field hours. First half-year. (II)

Meteorology (Geography *B*).
Mon., Wed., Fri., at 10, a laboratory conference of one hour on Tu., between 9 and 12, and additional laboratory hours. Second half-year. (II)

Elementary Geology (Geology 4).
Wed., Fri., and occasionally Mon., at 12. (IV)

Elementary Field and Laboratory Geology (Geology 5).
Laboratory work (*two hours, twice a week, in February and March*); Section A, *Tu., Th., 11-1;* or B, *Tu., Th., 2.30-4.30;* or C, *Wed., Fri., 2.30-4.30;* (*in April and May*) field work, *Th. or Fri.* (*one half-day a week*), and laboratory work, *Tu. or Wed.* (IV)

Qualitative Analysis (Chemistry 3).
Mon., Wed., Fri., at 11; laboratory work, *nine hours a week.* (III)

General Descriptive Physics (Physics 1).
Tu., Sat., at 10; laboratory work (*two hours a week, Tu., Wed., Th., or Fri.*). (VIII)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (XIII)

Advanced German (German 1*c*).
Tu., Th., Sat., at 9. (VII)

Or Advanced French (French 1*b*).
Mon., Wed., Fri., at 9. (IX)

Summer work (prescribed) Geology S 2.

THIRD YEAR.

General Critical Geology (Geology 8).
Wed., Fri., and occasionally Mon., at 9, with additional hours for conference and field-work. (I)

Palaeontology (Geology 14).
Wed., Fri., and occasionally Mon., at 10. (II)

Physiography of the United States (Geography 6).
Mon., Wed., Fri., at 12. Second half-year. (IV)

Or Physiography of Europe (Geography 7).
Mon., Wed., Fri., at 12. Second half-year. (IV)

Mineralogy (Mineralogy 2).
Mon., Wed., Fri., at 10; laboratory work, ***six hours a week.*** (II)

Elementary Zoölogy (Zoölogy 1).
Tu., Th., and (at the pleasure of the instructor) Sat., at 10; laboratory work, *three hours a week*, in five sections: I, *Tu., 9-10 and 11-1;* II, *Tu., 1.30-4.30;* III, *Th., 9-10 and 11-1;* IV, *Th., 1.30-4.30;* V, *Sat., 9-10 and 11-1. First half-year.* (VIII)

Elementary Botany (Botany 1).
Tu., Th., at 10, and a third hour at the pleasure of the instructor; laboratory work, *six hours a week*, in five sections: I, *Mon., Wed., Fri., 9-11;* II, *Mon., Wed., Fri., 11-1;* III, *Mon., Wed., Fri., 1.30-3.30;* IV, *Tu., Th., Sat., 11-1;* V, *Tu., Th., 1.30-3 30, and Sat., 9-11. Second half-year.* (VIII)

English Composition (English *C*).
I, *Mon., Wed., at 10;* II, *Mon., Wed., at 11;* III, *Tu., Th., at 10;* IV, *Tu., Th., at 11;* V, *Tu., Th., at 12.*

And either French 1*b* or German 1*c*, if not taken before.

Summer work (prescribed) Geology S 3.

FOURTH YEAR.

Mining Geology (Geology 10).
Tu., Th., Sat., at 10. (VIII)

Historical Geology (Geology 15).
Mon., at 3.30. (VI)

Geological field-work (Geology 22*a*).
Tu., at 4.30.

Petrography (Mineralogy 12).
Tu., Th., at 11, and an occasional third hour, with additional laboratory hours. (IX)

A thesis embodying the results of field and laboratory work.

And at least one full course or two half courses to be selected from the following list:—

Glacial Geology (Geology 16).
Wed., Fri., at 11, with additional hours for field-work in October and November, and for laboratory and library work in the winter. First half-year. (III)

Physiography (advanced course) (Geography 20).
Th., at 9, and a second hour at the pleasure of the instructor. (VII)

Pre-Cambrian Geology of North America (Geology 27).
First half-year.

Economic Geology (Geology 18).
Wed., Fri., and (at the pleasure of the instructor) Mon., at 4.30. First half-year.

Descriptive Astronomy (Astronomy 1).
Tu., Th., Sat., at 9. First half-year. (VII)

Practical Astronomy (Astronomy 2).
Tu., Th., Sat., at 9. Second half-year. (VII)

Crystallography (Mineralogy 7).
First half-year.

Physical Crystallography, mainly Optical Mineralogy (Mineralogy 8).
Second half-year.

Mineralogical and Petrographical Research (Mineralogy 20).

Fossil Invertebrates (Zoölogy 9).
Tu., Th., at 10; also laboratory hours. (VIII)

Quantitative Analysis (Chemistry 4).
Mon., Wed., Fri., at 3.30; laboratory work, *nine hours a week.* (VI)

Freehand Drawing (Fine Arts 1).
Mon., Wed., Fri., at 2.30, and additional hours for drawing. (V)

BIOLOGY.

Students who complete this course, pass the required examinations and present a satisfactory thesis will receive the degree of Bachelor of Science in Biology.

First Year.

Elementary Zoölogy (Zoölogy 1).
Tu., Th., and (at the pleasure of the instructor) Sat., at 10; laboratory work, *three hours a week*, in five sections: I, *Tu., 9–10 and 11–1;* II, *Tu., 1.30–4.30;* III, *Th., 9–10 and 11–1;* IV, *Th., 1.30–4.30;* V, *Sat., 9–10 and 11–1. First half-year.* (VIII)

Elementary Botany (Botany 1).

Tu., Th., at 10, and a third hour at the pleasure of the instructor; laboratory work, *six hours a week*, in five sections: I, *Mon., Wed., Fri., 9–11*; II, *Mon., Wed., Fri., 11–1*; III, *Mon., Wed., Fri., 1.30–3.30*; IV, *Tu., Th., Sat., 11–1*; V, *Tu., Th., 1.30–3.30, Sat., 9–11. Second half-year.* (VIII)

Morphology of Animals (Zoölogy 2).

Mon., Wed., Fri., at 2.30; laboratory work, *six hours a week. Second half-year.* (V)

Morphology of Plants (Botany 2).

Mon., Wed., Fri., at 2.30; laboratory work, *six hours a week. First half-year.* (V)

*Experimental Physics (Physics *B*).

Wed., at 12; laboratory work, *two hours a week.* (IV)

Physiography (Geography *A*).

Mon., Wed., Fri., at 10, a laboratory conference of one hour on Tu. between 9 and 12, and additional laboratory and field hours. First half-year. (II)

Meteorology (Geography *B*).

Mon., Wed., Fri., at 10, a laboratory conference of one hour on Tu. between 9 and 12, and additional laboratory hours. Second half-year. (II)

Rhetoric and English Composition (English *A*).

Divided into sections. I, *Mon., Wed., Fri., at 10*; II, *Mon., Wed., Fri., at 11*; III, *Mon., Wed., Fri., at 12*; IV, *Tu., Th., Sat., at 10*; V, *Tu., Th., Sat., at 11*; VI, *Tu., Th., Sat., at 12.* (X)

Advanced German (German 1*c*).

Tu., Th., Sat., at 9. (VII)

SECOND YEAR.

Physiology and Histology of Plants (Botany 3).

Tu., Th., at 2.30; laboratory work, *six hours a week.* (XI)

Comparative Anatomy of Vertebrates (Zoölogy 3).

Tu., Th., Sat., at 9; laboratory work, *six hours a week.* (VII)

General Descriptive Chemistry (Chemistry 1).

Mon., Fri., at 12; laboratory work, *Wed., 1.30–4.30.* (IV)

Experimental Physics (Physics *C*).

Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th. afternoons.* (XIII)

* Physics *B* may be omitted by those students who have passed in Experimental Physics for admission.

Or General Descriptive Physics (Physics 1).
Tu., Sat., at 10; laboratory work, (*two hours a week, Tu., Wed., Th., or Fri*). (VIII)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (XIII)

Advanced French (French 1*b*).
Mon., Wed., Fri., at 9. (IX)

THIRD YEAR.

Four courses are required for the third year. Of these the following two and a half courses are prescribed: —

Cryptogamic Botany (Botany 4).
Tu., Th., Sat., at 11; laboratory work, *six hours a week. Second half-year.* (IX)

Microscopical Anatomy (Zoölogy 4).
Mon., Wed., Fri., at 10; laboratory work, *six hours a week. First half-year.* (II)

Elementary Geology (Geology 4).
Wed., Fri., and occasionally Mon., at 12. (IV)

Qualitative Analysis (Chemistry 3).
Mon., Wed., Fri., at 11; laboratory work, *nine hours a week.* (III)

The remaining course and a half must be elected from the following list, but students proposing to do their fourth year thesis work in Zoölogy must include in their election Zoölogy 5.

Embryology of Vertebrates (Zoölogy 5).
Mon., Wed., Fri., at 10; laboratory work, *six hours a week. Second half-year.* (II)

Fossil Invertebrates (Zoölogy 9).
Tu., Th., at 10; also laboratory hours. (VIII)

Experimental Morphology.—Ontogenesis studied as a process (Zoölogy 10).
Tu., Th., at 3.30. (XII)

Or Experimental Morphology. — Phylogenesis studied as a process (Zoölogy 11).
Tu., Th., at 3.30. (XII)

These courses are given in alternate years.

Elementary Field and Laboratory Geology (Geology 5).
Laboratory work (*two hours, twice a week, in February and March*); Section A, *Tu., Th., 11-1;* or B, *Tu., Th., 2.30-4.30;* or C, *Wed., Fri., 2.30-4.30;* (*in April and May*) field-work, *Th.*, or *Fri.* (*one half-day a week*), and laboratory work, *Tu.* or *Wed. Second half-year.* (IV)

Advanced French (French 1*b*).
Mon., Wed., Fri., at 9. (IX)

The Nervous System and its Terminal Organs. — Sense Organs (Zoölogy 15).
Mon., Wed., Fri., at 9. First half-year. (I)

Or The Nervous System and its Terminal Organs. — Central Nervous Organs and Terminal Organs of Efferent Nerves (Zoölogy 16).
Mon., Wed., Fri., at 9. First half-year. (I)

Courses 15 and 16 are given in alternate years.

Systematic Botany (Botany 5).
Tu., Th., at 3.30, and Sat., at 10. (XII)

The Carbon Compounds (Chemistry 5).
Mon., Wed., Fri., at 9; laboratory work, *six hours a week.* (I)

General Introduction to Philosophy (Philosophy 1*a*).
Mon., Wed., Fri., at 2.30. (V)

Fourth Year.

Four courses are required for the Fourth Year.

In this year the student must pursue some original investigation to the extent of at least two courses under the direction of one of the Instructors in the Departments of Botany or of Zoölogy. During the first week of the year he must arrange with his special Instructor the plan of study which he proposes. At the end of the year he must present a thesis, giving the results of his studies.

The courses in which research can be conducted are the following: —

Structure, Development, Physiology, and Economics of Phanerogams (Botany 20*a*).

Structure and Development of Cryptogams (Botany 20*b*).

Anatomy and Development of Animals (Zoölogy 20*a*).

The remainder of the Fourth-Year is to be elected from the Third-Year elective list.

GENERAL SCIENCE.

This programme of study is intended for those who wish to lay a broad foundation for subsequent special work in Science. The studies in the First-Year are prescribed. In the three subsequent years the studies are to be chosen with the approval of some one Division of Science in the University and the work is to be done under the supervision of this division. For each of these three years five courses are required, and at least one of these courses each year must be taken in the supervising division. In the fourth year, at the option of the supervising division, a thesis may be substituted for one of the five required courses.

PRESCRIBED STUDIES FOR THE FIRST YEAR.

Algebra (Engineering 1*a*).
Mon., Wed., Fri., at 10. First half-year (II)

Trigonometry (Engineering 1*b*).
Tu., Th., at 10. First half-year. (VIII)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (II)

Mechanical Drawing (Engineering 3*a*).
I, *Mon., at 1.30;* draughting, *Mon., Fri., 1.30–4.30:* II, *Tu., at 1.30;* draughting, *Tu., Th., 1.30–4.30.* (XIII)

Experimental Physics (Physics *B*).
Wed., at 12; laboratory work, *two hours a week.* (IV)

And General Descriptive Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30, or Wed., Fri., 2.30–4.30.* (IV)

Or Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.*
Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th. afternoons.* (XIII)

Or General Descriptive Physics (Physics 1).
Tu., Sat., at 10; laboratory work (*two hours a week, Tu., Wed., Th.*, or *Fri.*). (VIII)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (X)

Elementary German (German *A*).
Mon., Wed., Fri., at 9. (XII)
Required of students who did not offer German for admission.

Or Elementary French (French *A*).
Mon., Wed., Fri., at 9. (XII)
Required of students who did not offer French for admission.

Or Advanced German (German 1*c*).
Tu., Th., Sat., at 9. (VII)

Or Advanced French (French 1*b*).
Mon., Wed., Fri., at 9. (IX)

SECOND, THIRD, AND FOURTH YEARS.

During the second, third, and fourth years the student must take five courses or their equivalent each year, to be chosen with the approval of the supervising division.

FOUR YEARS' COURSE FOR TEACHERS OF SCIENCE.

THIS course is intended for men who wish to qualify themselves to teach science in secondary schools or to become supervisors of science teaching in elementary schools. The work of the first year is prescribed. During each of the remaining three years the student must complete five courses, one of which must be a course in Education and Teaching; the other four courses the student chooses for himself, but he must obtain his adviser's approval of his programme of studies for each year.

It will be observed that this four years' course combines professional training for teachers and supervisors of teaching with training in science. The several courses in Education and Teaching are designed to furnish this professional training. The aim of these courses is threefold, namely: —

1. To discuss education as an important function of society, of interest to all university students whether they intend to become teachers or not.
2. To offer to university students who look forward to teaching as their profession the necessary professional training for their vocation.
3. To offer to graduates of colleges who have already had experience as teachers, and to all other teachers of suitable age and attainments, appropriate professional training for future usefulness as principals and superintendents of schools.

The courses include the history of education, an introduction to educational theory, the organization and management of public schools and academies and of city school systems, practice teaching, methods of teaching secondary school subjects, and a Seminary for the most advanced students for the special study of contemporary educational problems.

Two of these courses are introductory and general; the remaining courses are professional in character. The two introductory courses serve to acquaint the general student with the history of education, with its problems, and with such generally accepted principles, as may serve to guide his further study of the subject; at the same time they afford an appropriate introduction to the remaining courses which are intended to provide the essential preliminary professional training for those students who intend to become teachers in high schools and academies, or principals or superintendents of schools.

Through the courtesy of school officers and teachers in the vicinity of the University many schools are open for repeated inspection and prolonged study to University students who are pursuing these professional

courses. Through arrangements made with the neighboring cities of Newton and Medford, and the towns of Everett and Brookline, students have special opportunities to *teach for practice under direction* in these places.

The attention of graduates of normal schools is especially called to this course.

PRESCRIBED WORK OF THE FIRST YEAR.

Algebra (Engineering 1*a*).
Mon., Wed., Fri., at 10. First half-year. (II)

Trigonometry (Engineering 1*b*).
Tu., Th., at 10. First half-year. (VIII)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (II)

Logic and Psychology (Philosophy 1*a*).
Mon., Wed., Fri., at 2.30. (V)

Experimental Physics (Physics *B*).
Wed., at 12; laboratory work, *two hours a week.* (IV)

And General Descriptive Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30, or Wed., Fri., 2.30–4.30.* (IV)

Or Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* (XIII)

Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th. afternoons.*

Or General Descriptive Physics (Physics 1).
Tu., Sat., at 10; laboratory work (*two hours a week, Tu., Wed., Th.*, or *Fri.*). (VIII)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (X)

Elementary German (German *A*).
Mon., Wed., Fri., at 9. (XII)
Required of students who did not offer German for admission.

Or Elementary French (French *A*).
Mon., Wed., Fri., at 9. (XII)
Required of students who did not offer French for admission.

Or Advanced German (German 1*c*).
Tu., Th., Sat., at 9. (VII)

Or Advanced French (French 1*b*).
Mon., Wed., Fri., at 9. (IX)

Second, Third, and Fourth Years.

During the second, third, and fourth years the student must complete five courses or their equivalent each year, to be chosen with the approval of his adviser, one course each being selected from the courses in Education.

ANATOMY AND PHYSIOLOGY.

The aims of this course are as follows:—

1. To afford a suitable general training for young men who may desire afterwards to pursue the study of Medicine.

2. To educate youths who may need to take particular care of their bodily health, and therefore should have a knowledge of the subjects taught in the course as well as a systematic training in the use of their bodies.

3. To prepare persons who, with or without a subsequent training in Medicine, may intend to seek employment as directors of gymnasiums or instructors in physical training.

Students who intend to enter the Medical School may take the prescribed First-Year's work of that school in satisfaction of the requirements of the Fourth-Year laid down in this schedule; they will thus be enabled to enter the Second-Year class at the Medical School and graduate from there in three years.

Students who complete this course of study and pass the required examinations will receive the degree of Bachelor of Science in Anatomy and Physiology.

First Year.

†Experimental Physics (Physics *B*).
Wed., at 12; laboratory work, *two hours a week.* (IV)

Elementary Zoölogy (Zoölogy 1).
Tu., Th., and (at the pleasure of the instructor) Sat., at 10; laboratory work, *three hours a week,* in five sections: I, *Tu., 9–10 and 11–1;* II, *Tu., 1.30–4.30;* III, *Th., 9–10 and 11–1;* IV, *Th., 1.30–4.30;* V, *Sat., 9–10 and 11–1. First half-year.* (VIII)

Morphology of Animals (Zoölogy 2).
Mon., Wed., Fri., at 2.30; laboratory work, *six hours a week. Second half-year.* (V)

Morphology of Plants (Botany 2).
Mon., Wed., Fri., at 2.30; laboratory work, *six hours a week. First half-year.* (V)

† Physics *B* may be omitted by those students who have passed in Experimental Physics for admission.

Elementary Physiology and Hygiene (Hygiene 1).

Tu., Th., Sat., at 10. Laboratory work in sections: I, *Tu., 9–10 and 11–1;* II, *Th., 9–10 and 11–1;* III, *Sat., 9–10 and 11–1;* IV, *Wed., 9–12;* V, *Fri., 1.30–4.30. Second half-year.* (VIII)

General Descriptive Chemistry (Chemistry 1).

Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30, or Wed., Fri., 2.30–4.30.* (IV)

Rhetoric and English Composition (English *A*).

Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (X)

Elementary German (German *A*).

Mon., Wed., Fri., at 9. (XII)

Required of students who did not offer German for admission.

Or Elementary French (French *A*).

Mon., Wed., Fri., at 9. (XII)

Required of students who did not offer French for admission.

Gymnastics and Athletics. Dr. SARGENT and Mr. LATHROP.

SECOND YEAR.

Comparative Anatomy of Vertebrates (Zoölogy 3).

Tu., Th., Sat., at 9; laboratory work, *six hours a week.* (VII)

Elementary Geology (Geology 4).

Wed., Fri., and occasionally Mon., at 12. (IV)

Physiography (Geography *A*).

Mon., Wed., Fri., at 10, a laboratory conference of one hour on Tu., between 9 and 12, and additional laboratory and field hours. First half-year. (II)

Meteorology (Geography *B*).

Mon., Wed., Fri., at 10, a laboratory conference of one hour on Tu. between 9 and 12, and additional laboratory hours. Second half-year. (II)

Experimental Physics (Physics *C*).

Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th., afternoons.* (XIII)

Or General Descriptive Physics (Physics 1).

Tu., Sat., at 10; laboratory work (*two hours a week, Tu., Wed., Th.,* or *Fri.*). (VIII)

Qualitative Analysis (Chemistry 3).
Mon., Wed., Fri., at 11; laboratory work, *nine hours a week.* (III)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (XIII)

THIRD YEAR.

General Hygiene (Hygiene 10).
Tu., Th., and occasionally Sat., at 10; also laboratory work. *First half-year.* (VIII)

Also, four and a half courses to be selected from the following: —

History of Physical Education (Hygiene 2).
Tu., at 2.30. Second half-year. (XI)

Anthropometry (Hygiene 4).
Three times a week. First half-year.

Organic Chemistry (Chemistry 2).
Mon., Wed., Fri., at 9. First half-year. (I)

Quantitative Analysis (Chemistry 4).
Mon., Wed., Fri., at 3.30; laboratory work, *nine hours a week.* (VI)

The Carbon Compounds (Chemistry 5).
Mon., Wed., Fri., at 9; laboratory work, *six hours a week.* (I)

Microscopical Anatomy (Zoölogy 4).
Mon., Wed., Fri., at 10; laboratory work, *six hours a week. First half-year.* (II)

Embryology of Vertebrates (Zoölogy 5).
Mon., Wed., Fri., at 10; laboratory work, *six hours a week. Second half-year.* (II)

Experimental Morphology. — Ontogenesis studied as a process (Zoölogy 10).
Tu., Th., at 3.30. (XII)

The Nervous System and its Terminal Organs. — Sense Organs (Zoölogy 15).
Mon., Wed., Fri., at 9. First half-year. (I)

The Nervous System and its Terminal Organs. — Central Nervous Organs and Terminal Organs of Efferent Nerves (Zoölogy 16).
Mon., Wed., Fri., at 9. First half-year. (I)

Cryptogamic Botany (Botany 4).
Tu., Th., Sat., at 11; laboratory work, *six hours a week. Second half-year.* (XI)

Advanced Psychology (Philosophy 2).
Mon., Wed., Fri., at 12. First half-year. (IV)

FOURTH YEAR.

(AT THE MEDICAL SCHOOL).

Anatomy and Dissection.
Physiology.
Histology.
Physiological Chemistry.
Bacteriology.

DESCRIPTION OF COURSES.

The following brief description of the courses required in the various departments is added for the information of those who contemplate entering the School.

GREEK AND ROMAN ARCHAEOLOGY.

GREEK 10. — The Life of the Ancient Athenians, described and illustrated by the aid of the Literature and of the Monuments. Professor WHITE.

The courses Greek 10 and Latin 10 are made part of the four years' course in Architecture in order that the student may understand the civilization out of which grew the fundamental forms of his art, and may realize the connection existing between these forms and the life which they expressed.

Greek 10 will be given alternately with Latin 10. It is intended both for classical students and for others who have not been able to devote special attention in college to the classics, but who may nevertheless wish to make a systematic study of old Greek life. The ability to read Greek and Latin and to use German and French works of reference is desirable but is not required. The instructor will explain in an elementary way, but systematically, how the ancient Athenians lived. He will describe, for example, their houses and how they were furnished; their dress, coverings for the head and feet, and personal ornaments; their system of education; their marriage and funeral rites, entertainments, in-door and out-door sports, markets, shops, exports and imports; the trades and professions among them; their country life; their means of conveyance; how the ship was constructed, manned and rigged; how the horse was bridled and harnessed, etc., etc. The lectures will be illustrated as fully as possible by means of diagrams, casts of works of ancient art, books on art, and the stereopticon, which is provided with over a thousand slides.

Lectures will be given on Tuesdays and Thursdays; Saturdays will be devoted to illustration by means of the stereopticon and to collateral reading.

The course is given by lectures, but members of the class will be required to prepare for examination parts of the books named below, and occasionally also parts of other English books of reference. Of these the instructor will give some explanation and description at the first lecture. No collateral reading will be required in any other language than English; but the instructor will give references also to valuable works written in German and French for the benefit of those who can read these languages. All the books to which reference is made will be reserved for the use of the class in the Library of the Classical Department. Each member of the course will be required to write two short theses, involving elementary investigation.

Reference Books: Smith, *Dictionary of Antiquities* (third edition in 2 vols., 1890, Little, Brown & Co., Boston, $7 each vol.); Guhl & Koner, *Life of the Greeks and Romans* (Appleton & Co., New York, $2.50), or preferably the German edition under the title, *Das Leben der Griechen und Römer* (Weidmann, Berlin, *M.* 18); Blümner, *Home Life of the Ancient Greeks*, translated by Alice Zimmern (Cassell & Co., London, $2), or preferably the German edition under the title, *Leben und Sitten der Griechen* (Fryetag, Leipzig, *M.* 4.80).

*Latin 10. — The Private Life of the Romans, chiefly as illustrated by works of art. — Lectures, with collateral reading. Professor Greenough.

Latin 10 is given alternately with Greek 10.

This course, of the same grade and conducted in the same general way as Greek 10, is intended to give to classical students and others (see description of Greek 10) by lectures and the stereopticon, as complete a representation as possible of Roman private life. The equipment for this purpose includes the best illustrated works on classical antiquities, which are accessible to the student in the library of the Department or in the University Library, and about a thousand stereopticon slides. In addition to the examinations each student will be required to make a certain number of reports on special topics in a somewhat more minute way than the same topics can be treated in the lectures.

* This course is omitted in 1898–99.

ENGLISH.

ENGLISH *A*. Rhetoric and English Composition. — A. S. Hill's *Principles of Rhetoric* (revised and enlarged edition). — Lectures, recitations, written exercises, and conferences. Professors A. S. HILL and BRIGGS, and Messrs. HURLBUT, COPELAND, F. N. ROBINSON, COBB, SCHOFIELD, J. G. HART, LA ROSE, SHEFFIELD, and HUNTINGTON.

Mr. HURLBUT will have the general direction of Course *A*.

Course *A* is prescribed for Freshmen and for First-Year students in the Scientific School.

In the daily exercises the class will be divided into six sections; but at the Mid-Year and Final Examinations the whole class will be examined together, on the days assigned to the examinations in Group X. No student in Course *A* is allowed to take any other course in Group X.

Course *A* gives elementary instruction in the theory and the practice of English Composition. The theory of composition is taught throughout the year by lectures based on A. S. Hill's *Principles of Rhetoric* (revised and enlarged edition) and *Foundations of Rhetoric*, and by oral and written exercises; the practice is obtained in short themes, written in the class-room and criticised by the instructors.

Course *A* gives elementary instruction in the theory and the practice of English Composition. The theory of composition is taught throughout the year by lectures based on A. S. Hill's *Principles of Rhetoric* (revised and enlarged edition), and by oral and written exercises; the practice is obtained in short themes, written in the class-room and criticised by the instructors.

For the writing of themes the class is divided into six sections, which meet the instructors and write themes in the class-room on Wednesdays or Thursdays. These themes are read and criticised in detail by the instructors. They are then returned to the writers in person, at hours corresponding to those at which they were written; and they are generally rewritten on the spot, with the instructor's criticism in view. For the personal conferences and the rewriting of themes, each of the six sections is subdivided.

For the study of Rhetoric and the rewriting of the themes there are eighteen sections.

In addition to the study of Rhetoric and the writing and rewriting of themes, certain reading is required, but not more than one book a month. Among the books which have been prescribed are *Henry V.*, *Macbeth*, *Revolt of a Tartar Tribe*, *The Essays of Elia*, *The Scarlet Letter*, *The Golden Treasury*, *Treasure Island*, *The Jungle Book*, and in general

such books as the students in the course might read for their own pleasure.

Students who attain grade A or B in Course A are exempted from the prescription of English B or English BC.

ENGLISH *BC*. — English Composition. —Written exercises, and conferences. Messrs. HURLBUT, T. HALL, and HUNTINGTON.

Course *BC* is prescribed for students in the Scientific School who have passed in Course *A* with a grade lower than *B*. It is open only to those who have passed in Course *A*.

Course *BC* gives instruction in the elements and the qualities of style, and practice in Narration and Description, but mainly in Expository writing. It is specially adapted to the needs of students in the Scientific School, and to this end it is closely connected with their other courses.

The class meets at lectures once each week, and each student meets an instructor for personal consultation at least once in two weeks.

The written work consists of daily themes, fortnightly themes, and a thesis of not less than 1500 words. The thesis and some of the fortnightly themes are preceded by plans.

☞ No overdue theme will be accepted unless the writer satisfies the Secretary of the Scientific School that his failure to present it at the appointed time was unavoidable.

ENGLISH *C*. — English Composition. — Forensics. — A brief based on a masterpiece of argumentative composition. Three forensics preceded by briefs. Lectures, class-work, and conferences. Asst. Professor BAKER, and Messrs. T. HALL, PRESCOTT, and HUNTINGTON.

Course *C* is open to those students only who have passed in Course *B*, Course *BC*, Course 31, or Course 22.

Course *C* gives practice in Argumentative Composition. Baker's *Principles of Argumentation* is used as a text-book.

At the opening of the College year arrangements are made for enough sections to allow the class to meet, from October to Christmas, in groups of forty to fifty. In the class-room there are talks on the principles of argumentation, and exercises to test the student's knowledge of these principles. These exercises are an important part of the work, and, with an hour examination, count as the equivalent of a fourth forensic. Class-room work ends at the Christmas recess.

The questions proposed for discussion in Forensics are so distributed among the different Departments that by a proper choice of topics each student may bring his work in this course directly into relation with his

work in other courses. With the permission of Professor Baker, an argument written for another course may be handed in for any one of the Forensics in English *C*. A student is expected, in every case, to treat his chosen topic so that the resulting essay may be intelligible to a general reader.

Students attaining Grade *A* or *B* in the work up to the third Forensic, will not be required to write the last manuscript.

For one hour on each working day of the week an instructor in the course will be present for consultation in Sever 10.

Each forensic is to contain at least 1000 words and not more than 1500. It is read by one of the instructors, and is generally dealt with like the themes in English *B*. Like these themes, all forensics are to be carefully corrected, rewritten if necessary, and finally returned to the instructors.

Fuller information as to the forensic work will be found in the *Announcement concerning Forensics*, published and distributed at the beginning of the academic year. Every student is required strictly to observe the Rules of the Course printed in this *Announcement*.

☞ By the Regulations, no overdue forensic will be accepted unless the writer satisfies the Secretary that his failure to present it at the appointed time was unavoidable.

NOTE. — *A record will be kept of the attendance of students at the lectures in Courses A, B, BC, and C. At the beginning of the year each student will be assigned to one of the sections; and he will be expected to attend the meetings of that section only.*

GERMAN.

GERMAN *A*. — Elementary Course. — Grammar. — Translation from German into English, and elementary exercises in translating into German. Mr. NICHOLS, Dr. BIERWIRTH, Dr. POLL, and Messrs. W. G. HOWARD, and COAR.

Course *A* is equivalent to the Elementary German of the admission requirement, and is prescribed for Freshmen who did not present German in the examination for admission, and do not elect Course *B*.

The principal aim of Course *A* is to give the student a knowledge of German sufficient to enable him to read easy German at sight and translate simple English sentences into German. Special attention will also be paid to systematic training in pronunciation.

GERMAN 1c. — German Prose. — Subjects in Natural Science. — Reading at sight. Dr. BIERWIRTH, and Mr. COAR.

This course is intended to furnish drill in the reading of modern scientific German, and is recommended to students who are taking, or

who plan to take, special courses in Natural Science or in Medicine. An elementary knowledge of at least two of the Natural Sciences is requisite for success in this course. Dippold's *Scientific German Reader* is used as an introduction, and is followed by monographs on various subjects, in order to give the student as large a vocabulary as possible. The reading matter is taken from such books as: Hirzel's *Chemie;* Brewer's *Naturlehre;* Müller's *Die elektrischen Maschinen;* Helmholtz's *Ueber Goethe's Naturwissenschaftliche Arbeiten.*

FRENCH.

FRENCH *A*. — Elementary Course. — French Prose and Composition. Messrs. C. H. C. WRIGHT, LA MESLÉE, and FORD.

There will be at least three sections in this course, but all sections will be examined in Group XII.

Students in the Lawrence Scientific School are required to enter Section I, meeting on Monday, Wednesday, and Friday, at 9.

This course is equivalent to the Elementary French of the admission requirements, and is prescribed for Freshmen who have not presented French at the examination for admission.

The object of this course is to prepare students to follow the more advanced courses, but it may be taken by those desiring simply to acquire a fair reading knowledge of French. The work consists largely of translation from French into English, of sight-reading of simple French, and of translation from English into French, the exercises illustrating the elementary rules of grammar and the simpler rules of syntax, which are required to falicitate sight-reading of simple French prose. In the course of the second half-year connected passages of translation from English into French, short and easy summaries, in French, of passages from the books read in class, and easy dictations in French, form an important part of the work.

The following books will be used: Chardenal's *Complete French Course* (Allyn & Bacon); Grandgent's *Materials for French Composition*, Part I; Michelet, *Jeanne d'Arc;* Ludovic Halévy, *l'Abbé Constantin;* Dumas père, *la Tulipe noire;* Émile de Bonnechose, *Bertrand du Guesclin* (Macmillan & Co.); George Sand, *la Mare au Diable* (Heath & Co.). The English language will be used so far as is necessary to enable students to understand explanations clearly. At the final examination the student will be expected to have a knowledge of Elementary French grammar, to be able to translate at sight a passage of ordinary French prose, and to write an easy French composition.

FRENCH 1*b*. — French Prose, historical and general. Translation from French into English. Messrs. I. BABBITT and FORD.

Open to students who have passed in Course *A*, or have passed the admission examination in Elementary French.

This course is conducted in English.

It is prescribed for students in the Lawrence Scientific School, the scientific section meeting on Monday, Wednesday, and Friday, at 9; but all sections will be examined in Group IX.

Students who take Course 1*b* may take no other course in Group IX.

Course 1*b* is designed primarily for those who do not intend to enter subsequently the more advanced French electives, and, at the same time, wish to acquire a reading knowledge of French sufficient to enable them to use it as an instrument in connection with other studies. Composition will be studied only in so far as is necessary to insure accuracy and closeness of grasp upon idiom, and will be confined to dictations and easy exercises in translation from English into French, not requiring preparation outside the class. In addition to the regular reading, each student will be expected to do during the year — preferably in connection with one of his other electives — outside reading to the extent of a thousand pages, or about four average volumes. Lists of recommended books in History, Political Economy, and other subjects, will be furnished by the instructor; one only of the volumes thus chosen may be in fiction.

The following books will be partly read, partly translated: Dumas père, *les Trois mousquetaires* (Ginn & Co.); Thiers, *Expédition de Bonaparte en Egypte* (Holt & Co.); George Sand, *la Famille de Germandre* (Ginn & Co.); Thierry, *Récits des temps mérovingiens* (Hachette); Alfred de Vigny, *la Canne de jonc* (Heath & Co.); Balzac, *le Curé de Tours* (Heath & Co.); Taine, *les Origines de la France contemporaine* (Holt & Co.).

PHILOSOPHY.

PHILOSOPHY 1*a*. — General Introduction to Philosophy. — First half-year: Logic, Professor PALMER. The Relations of the Philosophical Sciences, lectures by several members of this and other Divisions. Second half-year: Psychology, Professor MÜNSTERBERG. — Jevons, Lessons in Logic; James, Psychology (briefer course). Professors PALMER and MÜNSTERBERG, assisted by Dr. RAND.

PHILOSOPHY 2. — Advanced Psychology. — Lectures, prescribed reading, and a thesis. Professor MÜNSTERBERG.

PHILOSOPHY 16. — The History of Educational Theories and Practices. — Lectures, discussions, and reports. — Two essays. Mr. LOCKE.

The object of this course is to make the student acquainted with the educational aims and practices of the past and with the most important educational classics, and thus enable him to obtain a foundation for the criticism of present theories and practices in the light of their historical evolution, and incidentally, to acquire many rules for guidance in the actual work of teaching.

Education in Greece and Rome, and during the Middle Ages will be briefly considered. Most of the year will be devoted to the history of Education and Teaching since the Renaissance in Europe, and some time will be given to the history of Education and Teaching in the United States. Two essays are required and a course of reading is prescribed.

PHILOSOPHY 17. — Organization and Management of Public Schools and Academies. — Courses of Study, Supervision, and Teaching. — Lectures, Discussions, and Reports. Asst. Professor HANUS and Mr. LOCKE.

The general aim of this course is to enable all students to become familiar with and to understand the organization and administration of schools and school systems through direct observation and comparative study; to provide for young graduates and other students of suitable age and attainments an opportunity to acquire the teaching through study and practice; and to provide, through the opportunity for specialization which the course affords, special preparation for the work of principals and superintendents of schools. The course will be carried on in two sections, in accordance with the attainments, previous experience, and aims of the students. While much of the work is the same for both sections, the treatment of the same topics will differ somewhat in the two sections, and in Section II special attention will be given to the work of the class-room teacher, while in Section I special attention will be given to the duties of principals and superintendents of schools. During the year the students of Section II will have an opportunity to teach under direction in schools in the vicinity of the University (in the cities of Newton, Medford, Brookline), and it is expected that all graduate students who have had no experience as teachers will avail themselves of this privilege to the extent of at least two periods a week during half a year. While this privilege

of practice teaching is offered primarily to graduate students, yet other students of suitable age and attainments are not excluded from this privilege. But any student who shows persistent unfitness to teach will not be permitted to continue his practice teaching. In studying the school systems of American cities a detailed examination of their courses of study will be undertaken, and the principles on which any course of study should be based will be discussed. Attention will be given to details of school management such as the management of classes, examinations, promotions, and discipline; and to methods of teaching the elementary subjects. The duties of teachers, principals, and superintendents will be considered separately and in relation to each other. Students will study under direction the work of public schools and academies in the vicinity of the University. Reports of this work, written when required, will be submitted weekly. For fuller discussion of these reports and of the practice teaching referred to above a third hour may be arranged by the instructor. A course of reading is prescribed. At the end of the year each student will submit a thesis on the organization and work of a city school system, in which special attention must be given either to the course of study or to a detailed discussion of organization and management. In the first case the student will be expected to treat particularly his own speciality, for which all the details of the course of study, the teaching resources, and the methods of teaching must be fully considered. In the second case the student must develop his own plan for the organization and administration of a school system in detail, on the basis of a comparative study of existing systems. In Section I one or two state school systems and the school systems of England, France, and Germany will be considered as well as the systems of American cities.

PHILOSOPHY 18. — Introduction to Educational Theory. — Discussion of Educational Principles. — Lectures, reports, and discussions. — One essay. Asst. Professor HANUS.

The aim of this course is to enable the student to attain the conception that Education is a rationalized endeavor rather than a mere routine, and to make a critical examination of such generally accepted educational principles as may serve to guide the student in his further study of educational questions. The meaning and the scope of Education are defined, and its aims, means, and methods are examined. The special aims and general method of elementary and secondary education are treated separately and also in relation to each other. The following topics indicate the general character of the work: General Principles of Education, including the Scope and Meaning of Education; the relation of Psychology to Educational Theory and Practice; the Development of the

Individual; the Special Aims of Elementary and Secondary Education; Educational Values and Courses of Study; the Correlation of Studies; General Principles of Method; the Bearing of Instruction on Character; the Study of Children; Discipline and Moral Training; School Hygiene. The remaining time will be devoted to a study of selected educational literature. A course of reading is prescribed, and an essay is required.

*PHILOSOPHY 19*a*. — Methods of teaching Mathematics, Physics, Chemistry, Physical Geography, Botany, Zoölogy, Physiology, in Elementary and Secondary Schools. About ten exercises in each subject. Under the direction of Asst. Professor HANUS.

It is expected that Courses 19*a* and 19*b* will be given in alternate years.

PHILOSOPHY 19*b*. — Methods of teaching Latin, Greek, English, German, French, History, in Elementary and Secondary Schools. About ten exercises in each subject. One thesis on the work of the whole course. Under the direction of Asst. Professor HANUS.

The instruction in Courses 19*a* and 19*b* will be given by College teachers and by persons engaged in teaching in secondary schools.

The aim of these courses is to acquaint the student with the planning and the conducting of class work under the conditions existing in public schools and academies, together with the teaching resources in each subject. The thesis required of each student must comprise a discussion of the general principles involved in the teaching of Science for Course 19*a* and of languages for Course 19*b*, and must also comprise for each course a special discussion of the methods of teaching those particular subjects in which the student is especially interested.

PHILOSOPHY 20*g*. — Pedagogical Seminary. — *Subject for the year:* Contemporary Problems in Education, more particularly Secondary Education and the Organization and Management of Schools and School Systems. — Lectures, essays, reports, and discussions. Asst. Professor HANUS.

This course is intended only for the most advanced students. At the outset a general survey of present problems in education will be undertaken. Such problems include questions pertaining to the Improvement of the School Course of Study, Educational Values, City and District

* This course is omitted in 1898–99.

Organization of Schools and School Systems, the Proper Equipment for Effective Work, and the Methods of Teaching. Soon after the Seminary is organized, each member is expected to select some topic or topics for special study, and later, to present the results of this study to the Seminary in the form of at least one essay during each half-year. Much stress is laid on the essays and the discussions based on them. In addition to the work in his special topic, each member of the Seminary is required during the year to submit to the instructor a critical discussion of the educational doctrines of one of the following educational reformers: Comenius, Rousseau, Pestalozzi, Froebel, Herbart; and to report once a month on the bibliography of that part of the field of education in which he is especially interested.

FINE ARTS.

FINE ARTS 1. — Principles of delineation, color and chiaroscuro. — Lectures (once a week) with collateral reading. — Practice in drawing and in the use of water-colors. — Perspective. Professor CHARLES H. MOORE, assisted by Mr. MOWER.

This is a course on the theory of the graphic arts as modes of expression. It at the same time includes the study of nature from an artistic point of view, and aims to cultivate the eye, and in some measure to train the hand. The instruction is given by lectures and collateral reading and by practice in drawing with the point and in water-colors. In the drawing and coloring exercises the theoretic aim of this course is kept steadily in view. These exercises serve to fix in the mind of the student the fundamental principles of graphic art, and for the student of architecture a solid foundation is laid for the continued practice in freehand drawing which is to follow.

The books chiefly referred to will be the following: — Ruskin's *Modern Painters* and *Elements of Drawing*; Longfellow's *Abstract of Lectures in Perspective*; Sir Joshua Reynold's *Discourses*; Hammerton's *Thoughts about Art*.

FINE ARTS 3. — The History of Greek Art with an Introduction on the Arts of Egypt, Assyria, and Phoenicia, in their relations to Greek Art. Mr. E. ROBINSON.

FINE ARTS 4. — Roman and Mediaeval Art. Professor CHARLES H. MOORE.

Courses 3 and 4 in the Department of Fine Arts are devoted to the history of these arts from the earliest times to the seventeenth century of our era. In Course 3 the general characteristics of the arts of Egypt and Assyria are treated, but special attention is given to the development and

principles of Greek art with reference to its importance as an illustration of the life and Spirit of the Greeks, in connection with the other forms in which their genius showed itself, and with the events of their political history.

Course 4 deals in a similar manner with the architecture, sculpture, and painting of the Romans, of the Middle Ages, and of the Renaissance.

These courses are given in alternate years.

ARCHITECTURE.

ARCHITECTURE 1*a*. — Technical and Historical Development of the Ancient Styles, with special reference to Classic Architecture. — Lectures and practice in the drawing-room. Asst. Professor WARREN.

This course is open to students in the College who have taken both fine Arts 1 and Fine Arts 2, and who have obtained at least Grade *C* in both courses.

The first few weeks of the course will be devoted to gaining facility in the simple representation of architectural form, with some study of the elementary principles of projection and perspective drawing and shades and shadows. The history of ancient architecture will then be taken up. The gradual development of architectural forms and the technical processes of building will be traced, beginning with a summary study of the buildings of Egypt, Assyria, and Persia, and passing on to the more thorough and detailed consideration of the architecture of Greece and Rome. Students will be required from time to time to make drawings and written reports in illustration of the lectures. During the course the elements of Classical architectural form, especially the Greek and Roman orders, and their uses will be considered. The more important buildings will be examined in detail, and the structural and aesthetic principles on which their design depends will be critically studied. The course will be so conducted as to make the greatest possible use of the library to familiarize the student with books and their use. The course is not merely historical, but aims to lay the foundation of a working knowledge of architectural form and thus serves as an introduction both to Courses 1*b* and 1*c*, which continue the history of architecture, and to Course 4*a*, which begins the study of architectural design. The courses in history include a study of ornament and of the principles of ornamental design.

N. B. — The ability to use French and German reference-books with ease will be found valuable, though not essential.

Reference-books: Reber, *History of Ancient Art;* Perrot and Chipiez, *History of Art in Ancient Egypt; — in Chaldaea and Assyria; — in*

Persia; Maspero, *Egyptian Archaeology;* Babelon, *Manual of Oriental Antiquities;* Laloux, *l'Architecture grecque;* Durm, *Die Baukunst der Griechen;* Durm, *Die Baukunst der Etrusker und Römer;* Martha, *l'Archéologie etrusque et romaine;* Choisy, *l'Art de bâtir chez les Romains;* Bühzmann, *Die Architektur des classichen Alterthums und der Renaissancé.*

ARCHITECTURE 1*b*. — Technical and Historical Development of the Mediaeval Styles of Architecture. — Lectures and practice in the drawing-room. Asst. Professor WARREN.

ARCHITECTURE 1*c*. — Technical and Historical Development of the Renaissance and Modern Styles of Architecture. — Lectures and practice in the drawing-room. Asst. Professor WARREN.

Courses 1*b* and 1*c* are given in alternate years, and are taken by the Second and Third-Year men together; so that one set of students, following the chronological order, continues the studies of the First-Year, which close with the decline of Roman art, by taking up in the Second-Year the study of the Mediaeval art which grew out of that decline, and completes the history of architecture in the Renaissance and Modern styles; while another set of students passes from Roman architecture to its revival in the fifteenth century, and goes back to study the Mediaeval styles.

In these courses the study of the history of architecture will be continued by means of lectures and the making of drawings and written reports by the students illustrative of them. There will be the same insistence on the acquirement of familiarity with the forms that are met with, and their proper use. From time to time special subjects of research will be given out which the students will be expected to investigate for themselves, under guidance, by means of engravings and photographs, and upon which written reports will be required.

In the latter part of the year a series of lectures will be delivered on the history of ornament with practice in decorative design.

The endeavor will be to study the history of architecture not so much archaeologically as in a more vital way with reference to actual practice; to obtain a knowledge of principles of design by an analysis of the growth of architectural form and its use, regarding the buildings that are studied not as objects of contemplation or as historical documents, but as examples of various methods of work carried out under certain conditions; to study architectural form and composition by means of the history of architecture; to study, in short, not merely styles but style.

Reference-books: In Course 1*b* — Essenwein, *Die Ausgänge der classischen Baukunst;* Essenwein, *Die Fortsetzung der classichen Baukunst im oströmischen Reiche;* Choisy, *l'Art de bâtir chez les Byzantins;*

Bayet, *l'Art byzantin;* Dehio und v. Bezold, *Kirchliche Baukunst des Abendlandes;* Moore, *Development and Character of Gothic Architecture;* Violett-le-Duc, *Dictionnaire raisonné de l'architecture française;* Chateau, *l'Architecture en France;* Parker, *Introduction to the study of Gothic Architecture;* or *A B C of Gothic Architecture;* Paley, *Gothic Mouldings.* In Course 1c — Burkhardt, *Geschichte der Renaissance in Italien; Der Cicerone;* Lübke, *Die Renaissance in Frankreich; Geschichte der deutschen Renaissance;* Palustre, *l'Architecture de la Renaissance;* Muentz, *Histoire de l'Art pendant la Renaissance;* Symonds, *Renaissance in Italy;* Anderson, *Architecture of the Renaissance in Italy.*

ARCHITECTURE 2*a*. — Elementary Architectural Drawing. Asst. Professor WARREN and Mr. NEWTON, assisted by Mr. SWAN.

This course is illustrative of Course 1*a*, and is open only, except by special permission, to those students who are taking Course 1*a* in the same year, and must be taken by all who are taking Course 1*a*, unless exempted by special permission.

The drawing-room is open to students from 9 A.M. to 9 P.M. An instructor is usually present during the day-time. Students of architecture in their First-Year should give all their spare time to their drawing. After some preliminary work the time is devoted to making a series of carefully rendered drawings of simple buildings, or portions of buildings, and of standard examples of each of the orders. This not only gives the necessary practice in draughtsmanship, but familiarizes the student with the best forms of the orders. Students are encouraged to make their own selection of the examples to be drawn, subject to the approval of the instructors. The drawings form in effect a series of illustrations to the lectures in Course 1*a*. An exhibition is made of each series of plates as completed, and the work is then criticised before the class.

ARCHITECTURE 3*a*. — Freehand Drawing from Architectural Subjects. Asst. Professor WARREN and Mr. NEWTON, assisted by Mr. SWAN.

This is a course for practice in drawing especially arranged for students of architecture, in continuation of Fine Arts 1. It includes practice with pencil, pen, and brush, giving the student a careful training in the simplest method of expressing an architectural subject, whether a fragment of detail or a building.

ARCHITECTURE 3*b*. — Freehand Drawing from Architectural Subjects (second course). Asst. Professor WARREN and Mr. NEWTON, assisted by Mr. SWAN.

In this course the student is permitted more freedom, and individuality in the handling of his subject is encouraged. The works of the best

draughtsmen are put before him, and after the severer training of the preceding course he may treat his subjects in his own way under the direction of the instructor, always with a view to producing a pleasing composition in light and shade, as well as in form.

ARCHITECTURE 3*c*. — Freehand Drawing from Architectural Subjects (third course). Asst. Professor WARREN and Mr. NEWTON, assisted by Mr. SWAN.

Especial attention will be given in this course to the composition of drawings, which is not only essential to the artistic presentation of architectural subjects, but is of great aid in cultivating the sense of composition in architectural design, which depends upon the same principles. Studies principally from Turner, Harding, Cotman, and Claude Lorraine will be carried on. In a measure this course will be a resumé of Fine Arts 1, putting into practical use the principles there taught and familiarizing the student with the works of the masters best illustrating them. In the latter part of the course instruction will be given in figure drawing, the casts in the Fogg Art Museum from the antique and from mediaeval and renaissance masters being used as models.

These courses give the necessary daily practice in freehand drawing, which alone will enable the student of architecture to obtain the knowledge of form and facility in its representation which an architect needs. Instruction is given in the use of pencil, pen, and water-colors. Work will be done from the flat and from the round. The increasing collection of examples of good draughtsmanship, which the department possesses, and the photographs and casts will be used as models. Nearly all the work will be done from architectural subjects, so that the student may be adding to his store of knowledge of architectural form at the same time that he acquires mastery of his hand.

ARCHITECTURE 4*a*. — Elementary Architectural Design. Asst. Professor WARREN and Mr. NEWTON, assisted by Mr. SWAN.

This course is open to those students only who have passed satisfactorily in Course 1*a* and 2*a*, or satisfy the instructors that they have done equivalent work. *All the courses in design will require the student to devote all the time he can possibly give to the work.* The hours given indicate merely the time when the instructors will certainly be present, and the hours upon which lectures will probably fall when they are given. The drawing-room is open from 9 A.M. to 9 P.M., and an instructor is usually present in the day-time. During the first weeks of the course the student will be occupied in making carefully-rendered drawings of standard examples of architectural composition and in weekly exercises in design

from dictation; in this way the memory and imagination of the student will be stimulated and the knowledge of form acquired during the first year will be made use of and fixed in the mind. Following this introduction the study of architectural design will be farther pursued (1) by means of occasional lectures on the principles of design and of planning, and (2) by means of problems of an elementary nature, which will be given out from time to time as exercises in original composition. These designs will be carefully elaborated under the constant direction and criticism of the instructors, and when completed will be criticised before the whole class.

ARCHITECTURE 4*b*. — Architectural Design (second course). Asst. Professor WARREN and Mr. NEWTON.

This course is open to students who have passed satisfactorily in Course 4*a*, of which it is a continuation.

As in the previous course, the work will be carried on by means of problems and criticisms, and occasional lectures. The study of planning will be taken up systematically, and lectures will be delivered on the right artistic treatment of the various materials used in building.

In the work in design the forms of classical architecture will be mainly used, as the object of the course is to give a mastery of technique and of composition, and this can better be done by endeavoring to secure as complete a mastery of one style as the limited time of the course will allow, rather than by scattering the energies in an impossible attempt to secure adequate knowledge of several styles. Some exercise in historic designs in other styles will be given. For this purpose the classical styles are preferred because of the simplicity of their fundamental forms and because these forms lie at the foundation of all modern styles. The problems proposed in the courses on design will be selected with a view to stimulating as far as possible whatever imagination or poetic feeling the student may possess at the same time that they give practice in various classes of architectural composition. In the main they will be such as depend upon present American conditions: not merely conventional chool problems without relation to our time or civilization.

ARCHITECTURE 4*c*. — Architectural Design (advanced course.) — Lectures and practice. Asst. Professor WARREN and Mr. NEWTON.

This course is open to students who have passed satisfactorily in Course 4*b*. During the first half of the year the lectures given will be devoted mainly to a consideration of the requirements and planning of modern buildings: such as schools and other educational institutions, museums, public libraries, railroad stations, town halls, theatres and concert halls,

commercial and domestic buildings. Several problems in the design of such buildings will be given out. A number of lectures will be given in connection with this course on landscape gardening in its relation to architecture. The method of instruction will be the same as in the previous course.

The second half of the year will be devoted to thesis work.

ARCHITECTURE 5. — Carpentry. — Lectures and drawing. Mr. NEWTON.

ARCHITECTURE 6. — Practice in modelling architectural ornaments in clay. Mr. GARBUTT.

Architectural Library.

The library of the department of architecture is open every week day during term time from 9 A.M. to 5 P.M., except on Saturdays, when it will close at 1 o'clock. Students are encouraged to make the freest use of the books, photographs, and drawings it contains. It is intended essentially as a reference library, and contains all the more important works referred to in the courses on architectural history, and in the lectures on the theory of design; but most of the books have been chosen with regard to the work of the drawing-room, and especially to facilitate the practical work in design.

The larger and more expensive books are not to be removed from the building. The octavos and other volumes of moderate size may, on application to one of the instructors, be taken out after 4 o'clock, but must be returned before 10 o'clock on the following morning. On Saturday such books may be taken out after 12 o'clock, to be returned before 10 o'clock on the following Monday morning. Such books or photographs will be charged to the student borrowing them, and he will be held responsible for their safe return at the specified time. Any student who does not comply with these regulations will be deprived of the privilege of borrowing.

To facilitate the use of the large and valuable collection of works on Architecture and the other Fine Arts in the University Library, a catalogue of these books is kept in the department library, as well as a catalogue of the Architectural books in the Boston Public Library.

Fogg Art Museum.

The Fogg Art Museum is open daily to all members of the University from 9 A.M. to 5 P.M. On Sundays it is open from 1 to 5 P.M. On the ground floor will be found (1) in the small middle rooms on the east side, casts from Egyptian and Assyrian sculptures; (2) in the main hall, casts from Greek and Roman sculptures; (3) in the northeast room, casts from sculptures of the Italian Renaissance; (4) in the middle east room, casts

from sculptures by Michael Angelo; and (5) in the southeast room, casts from Mediaeval sculpture. In the southwest room is a classified collection of electrotypes from Greek and Roman coins loaned by the Classical Department, and a case of antique vases. In all of these rooms explanatory photographs are hung.

On the upper floor, in the main corridor, a series of photographic reproductions from drawings by Italian and German masters of the Renaissance, together with some solar enlargements from photographs of the Parthenon, the Erechtheum, and other Greek monuments, are permanently placed. The main galleries on this floor will, for the present, be used for the display of photographs illustrating the arts of various schools. This gallery contains also a few copies in water and oil color from portions of important examples of Florentine and Venetian painting, a few excellent copies from water color drawings by Turner, and a few facsimiles from typical examples of French manuscript illuminations of the twelfth and thirteenth centuries. A collection of over twenty thousand photographs, a large proportion of which is of architectural subjects, is accessible to students in the photograph room. In this room large tables, with table easels, are provided for their convenient examination, and facilities for drawing and tracing will be afforded for qualified students.

MATHEMATICS.

ENGINEERING 1*a*. — Engineering Mathematics. — Algebra. Messrs. LOVE and ASHTON, Dr. SAFFORD, and Messrs. FRIZELL and CAMPBELL.

This course is open to students who have passed satisfactorily the examination in Algebra required for admission to the Scientific School. The topics treated include the Progressions, Surds, Imaginaries, Theory of Quadratic Equations, Binomial Theorem, Limiting Values, Undetermined Coefficients, Partial Fractions, Convergency of Series, Logarithms, and General Theory of Equations.

Text-book: Sevenoak's revision of Hall and Knight's *Algebra for Colleges and Schools.*

ENGINEERING 1*b*. — Engineering Mathematics. — Trigonometry. Messrs. LOVE, ASHTON, FRIZELL, and CAMPBELL.

This course is open to students who have passed satisfactorily in the Algebra and Geometry required for admission to the Scientific School. The topics treated include Trigonometric Functions, Trigonometric Tables, Solution of Triangles, Trigonometric Equations, Radian Measure of Angles, and applications of these subjects.

Text-book: Nicholson's *Plane and Spherical Trigonometry.*

ENGINEERING 1*d*. — Engineering Mathematics. — Analytic Geometry. Messrs. LOVE and ASHTON, Dr. SAFFORD and Mr. FRIZELL.

This course is open to students who have passed satisfactorily in Courses 1*a* and 1*b*, or their equivalents.

The work in the course includes a study of the Geometry of the Straight Line, Circle, Parabola, Ellipse, and Hyperbola by the use of Rectangular Co-ordinates, also Transformation of Co-ordinates, Polar Co-ordinates, and General Problems in Loci.

Text-book: Bailey and Wood's *Analytic Geometry*.

ENGINEERING 1*c*. — Engineering Mathematics. — Solid Analytic Geometry. — Differential and Integral Calculus. Messrs. LOVE, FRIZELL, and CAMPBELL.

This course is open to students who have passed satisfactorily in Courses 1*a*, 1*b*, and 1*d*, or their equivalents, and have passed all the mathematical subjects required for admission.

In Solid Analytic Geometry, the work includes a simple treatment of Rectangular and Polar Coördinates in Space, the Point, the Plane and the Straight Line, Surfaces of Revolution, Ellipsoids, Paraboloids, Hyperboloids, etc.

In the Calculus are treated: — Differentiation; Maxima and Minima; Applications to Plane Curves; Developments in Series; Integration; Definite Integrals; Applications to Lengths, Areas, Surfaces, Volumes, Centers of Gravity, Motion, Moments of Inertia; Successive and Partial Differentiation; Indeterminate Forms; Contact and Curvature; Lengths of Space Curves; Successive Integration; Surfaces and Volumes of Solids of Revolution, etc.

Text-book: Bailey and Wood's *Analytic Geometry*, and Love's *Notes on Calculus*.

ENGINEERING 1*f*. — Engineering Mathematics. — Differential and Integral Calculus. Mr. LOVE.

This course is open to students who have passed satisfactorily in Course 1*c*, or its equivalent. It is intended as an optional course for advanced students of Engineering.

The work in this course consists of a fuller treatment of some of the topics introduced in Course 1*c*, such as Definite Integrals; Applications to Geometry, Physics, and Mechanics; Multiple Integrals; and Differential Equations.

Text-books: Osborne's *Examples of Differential Equations*, Peirce's *Table of Integrals*.

Reference-books: Byerly's *Differential and Integral Calculus;* Murray's *Differential Equations*.

MATHEMATICS 5. — Differential and Integral Calculus (second course). Professor BYERLY.

A student who takes this course must have a thorough acquaintance with the first principles of the Differential and Integral Calculus.

The course will embrace the various methods of Integration, systematically treated; Multiple Integrals; Partial Differentiation; Infinite Series; Elliptic Integrals; Definite Integrals and the Γ-Function; the simpler Total Differential Equations that occur in Applied Mathematics; Cauchy's Integral and Taylor's Theorem. Throughout the course, constant application of the principles studied will be made to problems in geometry and applied mathematics.

The student should have Byerly's *Differential Calculus* (Ginn & Co.) and Byerly's *Integral Calculus* (2d ed., same publishers), and Osgood's *Introduction to Infinite Series* (published by Harvard University).

MATHEMATICS 10.—Trigonometric Series. — Introduction to Spherical Harmonics. — Potential Function. Professors BYERLY and B. O. PEIRCE.

The first part of this course is an introduction to the treatment of some of the important Linear Partial Differential Equations which lie at the foundation of modern theories in Physics, and deals mainly with the methods of building up solutions of a differential equation from easily obtained particular solutions, in such a manner as to satisfy given initial conditions. Fourier's Theorem and its application to the solution of problems in the Conduction of Heat and in Acoustics will be taken up, and the course will include a treatment of the theory of Spherical Harmonics and Bessel's Functions. In this part of the course, Byerly's *Fourier's Series and Spherical Harmonics* (Boston, Ginn & Co.) will be used.

The second part is devoted to the properties and uses of Force Functions in general, and of the Newtonian Potential Function in particular, and to the application of the last-named function to the solution of problems in Electrostatics, Electrokinematics, Magnetism, and Electromagnetism. In this part of the course, B. O. Peirce's *Elements of the Theory of the Newtonian Potential Function* (Boston, Ginn & Co.) will be used.

ASTRONOMY.

ASTRONOMY 1 (formerly Engineering 2*a*). — Descriptive Astronomy. Dr. WILLSON and Mr. REED.

ASTRONOMY 2 (formerly Engineering 2*b*). — Practical Astronomy. —Application of Astronomy to Navigation and Exploration. —Time, latitude, and longitude, by sextant; azimuth; lunar distances. — Lectures, use of instruments, and computation. Dr. WILLSON and Mr. REED.

This course requires a knowledge of Descriptive Astronomy, Solid Geometry, and Trigonometry.

ENGINEERING COURSES.

ENGINEERING 3*a*. — Mechanical Drawing. — Use of Instruments. — Projections and Machine Drawing. Messrs. MOSES, KENNEDY, and ——.

This course is given during the first year for all students of Engineering. It is intended to supply a good working knowledge of the elements of mechanical and freehand projection drawing, and of their application to the representation of machinery and other engineering structures. It also serves as an introduction to Descriptive Geometry and other courses requiring a knowledge of drawing. At the end of the course, students are expected to understand and to read Mechanical Drawings and to have some facility in the measurment and delineation of Machines and Structures. Particular attention is paid to rapid freehand work made as nearly as possible to scale.

The subjects are taken up in the following order: during the first half-year, the Use of Instruments; the Stretching of Paper; Problems in Geometrical Drawing; Orthographic, Isometric, and Oblique Projections; Freehand and Instrumental Lettering; India-ink Tinting; Tracing and Blue Printing; and the Practice of Freehand Projection Drawing; — during the second half-year, Working Drawings of Structures and Machines, with a continuation of Freehand Sketching.

Reference-books: Anthony's *Mechanical Drawing* and *Machine Drawing*.

ENGINEERING 3*b*. — Descriptive Geometry. — Elementary Shades, Shadows, and Perspective Messrs. MOSES and KENNEDY.

This course is open to students who have passed satisfactorily in Course 3*a* or Architecture 2*a*.

It consists of problems in the projection of points, lines, planes, and curved surfaces with their tangencies, intersections, and developments, and the elements of shades, shadows, and perspective. It is designed to give a knowledge of the principles of Descriptive Geometry and their application to the solution of problems involving geometrical forms of most common occurrence in Engineering and Architecture. The work in shades, shadows, and perspective is devoted largely to the theory of those subjects, as the more practical methods are given in Course 3*c*.

Text-book: Church's *Descriptive Geometry*.

ENGINEERING 3*d*. — Mechanism. — Study of gearing and mechanical movements. Mr. MOSES.

This course is open to students who have passed satisfactorily in Course 3*c*. It may be counted towards the degree of A.B. with the consent of the Chairman of the Division.

In this course the transmission and change of motion by means of toothed wheels, link work, belts, and special devices are taken up in both their theoretical and practical aspects. Problems comprising these different modes of transmission are worked out in the draughting-room, particular attention being paid to the construction of teeth of wheels by exact and approximate methods. Analyses of simple machinery and calculations for trains of wheel work, belting, etc., are made in order to give the student thorough grounding in the principles of pure mechanism.

Text-book: Stahl and Wood's *Elementary Mechanism.*

ENGINEERING 3*e*. — Stereotomy. — Shades, Shadows, and Perspective. Mr. MOSES.

This course is open to students who have passed satisfactorily in Course 3*b*. It may be counted towards the degree of A.B. with the consent of the Chairman of the Department.

It consists mainly of problems in stereotomy, or stone-cutting, and in shades, shadows, and perspective. In stereotomy, drawings are made of constructions in stone with the working out of the necessary details and the developments of the separate parts. In shades, shadows, and perspective, special attention is given to architectural forms and to the shorter practical methods in general use by architects.

Students of Civil Engineering are required to take only the part of the course relating to Stereotomy.

Text-books: Siebert and Biggin's *Modern Stone Cutting and Masonry;* Millard's *Shades and Shadows.*

ENGINEERING 4*a*. — Surveying. — Use of Instruments, Plane and Topographical Surveying, Topographical Drawing, and Levelling. — Field practice. Messrs. TURNER and ——.

This course is open to students who have studied Plane Trigonometry. Without the Summer work it cannot be counted towards the degree of A.B.

The work of this course during the second half-year consists of topographical drawing and the study of the theory and adjustments of the several surveying instruments, together with their practical use in the field in working out problems. In the summer the work consists of a study of the methods of making land and topographical surveys, the student at the same time conducting such surveys in the field.

Text-book: Raymond's *Plane Surveying.*

Reference-books: Baker's *Engineering Instruments;* Gannett's *Topographic Methods; U. S. Coast and Geodetic Survey Reports;* Association of Eng. Socs. *Reports.*

ENGINEERING 4*c*. — Geodetic Surveying, — Field-work of triangulation. — The use of astronomical instruments in Surveying and Navigation. Messrs. TURNER and ——. (XIII)

This course is open to students who have passed satisfactorily in Courses 1*b*, 3*a*, and 4*a*. It cannot be counted towards the degree of A.B. unless taken with Course 4*d*. The two together count as one course.

The course includes the methods of measuring base lines with special reference to the use of the steel tape, observing angles, adjusting angle observations, determining absolute position, adjusting triangulations, trigonometrical levelling, precise spirit levelling, and projecting maps. Field Practice.

Text-book: *Geodetic Surveying*, by Merriman.

Reference-books: Chok's *U. S. Coast and Geodetic Survey Reports.*

ENGINEERING 4*d*. — Railroad Engineering. — Survey, location, and construction of railroads. — Field practice. Messrs. TURNER and ——.

This course is open to students who have passed satisfactorily in Course 4*a*. Without the summer work it cannot be counted towards the degree of A.B.

The course includes a study of the principles necessary to enable the engineer to select a route for a railroad, to determine the necessary grades and curves, to solve the problems incident to the location of the line upon the ground, to compute the quantities in excavation and embankment, and finally to lay the track in place. During the summer the students survey a line three or four miles long, take topography, make a map location, and adjust the location to the ground, computing the cost of construction.

Text-book: Searle's *Field Engineering.*

Reference-books: *Railroad Engineering Field Book* by Goodwin; Searles's *Spiral;* Wellington's *Economic Theory of the Location of Railways.*

ENGINEERING 4*e*. — Construction and Maintenance of Common Roads. Mr. MCCLINTOCK.

This course cannot be counted towards the degree of A.B.

The course is intended to furnish a training in the construction and maintenance of ordinary highways. The location and survey of roads are treated in reference to the conditions governing such work. Foundations and selections of materials, the treatment of the road materials in construction, and the surface finish for various classes of traffic,

receive careful attention. The various kinds of city pavements for heavy traffic are also considered. Students will be provided with opportunities for practical experience in the details of road building. The region in the vicinity of the School affords excellent examples of the various methods practised in constructing streets and other highways.

Text-book: Byrne's *Treatise on Highway Construction.*

ENGINEERING *5a.* — Analytic and Applied Mechanics. — Problems in Statics and Kinetics. Professor HOLLIS

This course is open to students who have passed satisfactorily in the Mathematics and Physics prescribed for the first and second years of the Engineering courses, or their equivalents.

The course in Mechanics is given during the third year. It includes the treatment of Statics and Kinetics from the standpoint of the engineer, dealing mainly, however, with the fundamental principles of Mechanics, and leaving for subsequent courses fuller and more detailed applications required in various branches of engineering practice. The elementary principles of Resistance of Materials are also considered. Special stress is laid upon the solution of problems by the students.

Reference-books: Rankine's *Applied Mechanics;* Weisbach's *Mechanics of Engineering.*

ENGINEERING *5b.* — Elementary Statics. — Graphical and Analytical Methods. Asst. Professor JOHNSON.

This course is open to students who have passed satisfactorily in Courses 1*a*, 1*b*, and 1*d*, or their equivalents.

The course is devoted to the study of Statics with special reference to the stability of structures and calculation of stresses. The structures treated include masonry dams and arches as well as the common types of construction in wood and steel, — not, however, including bridges.

While the aim of the course is to give special prominence to graphical methods, most of the problems will be solved analytically as well as graphically, not only for the sake of practice in testing the accuracy of work by comparing the results of the two independent solutions, but also that the relation between the two methods may be more perfectly understood.

ENGINEERING *5c* — Resistance of Materials. Professor HOLLIS.

This course is open to students who have passed satisfactorily in Course *5a.*

The course in Resistance of Materials is designed to give the student a comprehensive knowledge of the nature of all materials used in engineer-

ing construction, including the laws of their behavior under stress, both above and below the elastic limit. The application of theoretical formulas to structures is illustrated by numerous tests of iron, steel, cement, stone, and wood, in the testing-machines of the department, and the characteristics of materials are thus shown in a practical manner. The commercial tests and requirements are given from the standpoint of the practising engineer.

Text-book: Merriman's ***Mechanics of Materials.***

Reference-book: Burr's ***Elasticity and Resistance of Materials of Engineering.***

ENGINEERING *5d.* — Elementary Structural Design. Asst. Professor JOHNSON.

This course is open to students of Architecture who have passed satisfactorily in Course *5b*. It cannot be counted toward the degree of A.B.

The course is intended primarily for students of Architecture to prepare them to deal with the portions of architectural design in which questions of strength and stability are of special importance.

The course begins with a brief treatment of the fundamental principles of the Resistance of Materials, but most of the time is devoted to practice in the application of these principles in the solution of such problems as are of constant occurence in practice. These problems involve the design of wooden and steel beams, columns, girders, wooden and combination roof-trusses, etc.

Reference-books: Carnegie Steel Co.'s *Pocket Companion;* Johnson's ***Materials of Construction;*** Freitag's ***Architectural Engineering;*** Rivington's ***Series of Notes on Building Construction.***

ENGINEERING *6a.* — Hydraulics and Hydraulic Motors. — Flow of water in pipes. — Water wheels, turbines, and pressure engines. Messrs. TURNER and ——.

This course is open to students who take or have passed satisfactorily Course *5a*, or Mathematics 4.

The first part of the course is devoted to the study of the general theory of Hydraulics, which is more or less applicable to all branches of Hydraulic Engineering, including, among other things, the discussion of the laws governing the flow of water through orifices, over weirs, through tubes, and through pipes. The second part of the course is a study in the theory and practice of hydraulic motors. Visits are made to the Lowell and Holyoke water powers. Some time is given to the study of windmills.

Text-book: Merriman's ***Hydraulics.***

Reference-books: Hamilton Smith's ***Hydraulics;*** Francis' ***Lowell Hydraulic Experiments;*** Bodmer's ***Hydraulic Motors;*** Bovey's ***Hydraulics.***

ENGINEERING 6*c*. — Water Supply and Sanitary Engineering. Mr. G. S. RICE.

This course in open to students who have passed satisfactorily in Course 6*a*. It cannot be counted towards the degree of A.B.

It is given in the first term of the fourth year. The considerations necessary for the complete design of water-supply systems by gravitation, pumping, and ground storage, from the survey of the water-shed to the delivery into the house, are taken up in detail and in accordance with the latest practice.

The effects of soil on water, and the importance of the geological character of the water-shed, as well as the conditions effecting the plan of storage and determining the supply, are all carefully considered.

The pollution and filtration of potable waters, as well as the whole subject of sanitary engineering, including the best methods of utilization and disposal of sewage, are treated in the light of the latest experience.

Text-book: Fanning's *Practical Treatise on Water-Supply and Sanitary Engineering.*

ENGINEERING 6*d*. — Canals, Rivers, and Irrigation. — Measurements of the flow of water. — Construction of irrigation works. Mr. TURNER.

This course is open to students who have passed satisfactorily in Courses 6*a* and 8*a*. It may be counted toward the degree of A.B. with the consent of the Chairman of the Department.

The course includes: the study of rain-fall, evaporation, flow-off from the catchment area, methods of measuring river discharges with field work, the laws governing the flow in rivers, and methods of river improvement; the discussion of the theory of the flow in canals, and methods of constructing canals; the solution of the problems pertaining to irrigation engineering, such as the location and construction of canal head and regulating works, control and drainage works, and laterals and distributaries.

Reference-books: Fanning's *Water-Supply and Hydraulic Engineering;* F. H. Newell, in *U. S. Geological Survey Reports* and *Eleventh Census;* Humphrey and Abbott's *Mississippi River Experiments;* Wilson's *Irrigation Engineering.*

ENGINEERING 7*a*. — Bridges and Buildings. — Graphical Statics. — Details of iron and steel construction. — Lectures and draughting. Asst. Professor JOHNSON.

This course is open to students who take or have passed satisfactorily Course 5*c*. It cannot be counted toward the degree of A.B.

The course is intended to supply systematic training in the principles and methods involved in the economical design of iron and steel structures, such as bridges, roofs, and buildings.

The first part of the year is devoted to giving students a working knowledge of Graphical Statics, including the calculation of stresses from train-loads. In the latter portion of the course, each student works out complete designs of typical structures of moderate size. Special attention is given to encouraging business-like methods of making and recording computations. Students make working drawings of their projects, taking, however, no more time for such work than is necessary for making suitable presentation of their designs, and for obtaining some practice in expressing their own ideas clearly and in detail by drawing.

Special problems which arise in connection with structures other than those designed in detail by the student are taken up in lectures and exercises. In this work, a prominent purpose is to train the student in making prompt and correct application of general principles already familiar to him.

Such knowledge of rolling-mill, shop and erection practice as is needed for a clear understanding of the requirements of good design, is obtained from manufacturers' hand-books, from visits to neighboring bridge works, and to bridges and buildings in course of construction, and from lectures.

Text-book: Johnson, Bryan & Turneaure's *Theory and Practice of Modern Framed Structures* (latest edition).

Reference-books: Merriman & Jacoby's *Roofs and Bridges;* Carnegie Steel Co.'s *Pocket Companion;* Müller-Breslau's *Graphische Statik der Baukonstruktionen;* Johnson's *Materials of Construction*, and others.

ENGINEERING 8*a*. — Masonry and Foundations. Asst. Professor JOHNSON.

This course cannot be counted toward the degree of A.B.

Under the head of Masonry a study is made of the materials used in masonry construction, with reference to their physical properties, methods of preparation, cost, and their proper application to structures.

The different systems of foundations are described and discussed with reference to their comparative merits and proper fields of application. Some leading topics in this part of the course are piles, and pile-driving, coffer-dams, open caissons, pneumatic and open crib work, etc.

The course includes also a brief description of the principal features of tunneling.

Reference-books: Baker's *Masonry Construction;* Patton's *Foundations;* Drinker's *Tunneling;* Johnson's *Materials of Construction;* Degrand et Résal, *Ponts en Maçonnerie.*

ENGINEERING 10*a*. — Chipping, Filing, and Fitting. — Use of tools. — Fitting by hand. — Study of the metals in practical working. — Lectures and laboratory work. Mr. BURKE.

The workshop courses are open during the term to students who have no condition or deficiency. They may be taken on any two afternoons in the week, the days to be arranged to avoid interference at the beginning of the term. Classes will be made up immediately after the final examinations for five weeks' work in the Summer, during which time students of Mechanical and Electrical Engineering who, by reason of absence or deficiency, have not taken the workshop courses during the term will be required to take them. Other students who so elect may take these courses during the Summer. It is recommended that all students of Mechanical and Electrical Engineering take them at this time.

Courses 10*a*, 10*b*, 10*c*, and 10*e* cannot be counted toward the degree of A.B.

Students of Mechanical and Electrical Engineering are required, during the first two years, to spend about six hours a week in the blacksmith shop, pattern shop, foundry and machine shop. The shop work is supplemented by lectures on workshop practice and visits to the workshops within reach of Cambridge, as the aim of the courses is to give men a good practical knowledge of materials and the methods of manufacture adapted to the different engineering requirements. It is not manual craft that is considered desirable, but knowledge which will enable men to make economical and practical designs of machinery.

Courses 10*a* and 10*b* are given during the first year and the other courses during the second year. Each class is divided into sections for the purpose of reducing the number of students under instruction at one time and to avoid conflicts with other studies. It is considered desirable to take this work during the early part of the summer, when students can devote their entire time to it, and any workshop course may be omitted during the year, if so taken during the summer.

The Rindge Manual Training School, situated near the University, is at present used for the above-mentioned instruction. It has complete equipment for about one hundred and fifty students with all facilities for practical instruction in blacksmithing, fitting, finishing, and pattern-making.

ENGINEERING 10*b*. — Blacksmithing. — Use of tools. — Forging, welding, tool-dressing and tempering. — Lectures and laboratory work. Mr. BURKE.

ENGINEERING 10*c*. — Pattern Making and Foundry Practice. — Use of wood-working tools. — Casting in iron and alloys. — Lectures and laboratory work. Mr. BURKE.

ENGINEERING 10*e*. — Machine Shop Practice. — Use of machine tools. — Construction of parts of machinery; finishing and assembling parts. — Lectures and laboratory work. Mr. BURKE.

This course is open to students who have taken Courses 10*a* and 10*b*.

ENGINEERING 11*a*. — Machinery and Boilers. — Description of the different types of engines and boilers. — Elements of Thermo-Dynamics. Mr. L. S. MARKS.

This course is open to students who have passed satisfactorily in Course 3*a*. Wednesday afternoons must be kept free for visits of inspection.

The first half of the course is devoted mainly to a general study of the more common forms of steam machinery. The different types of steam boilers, their construction, setting, operation and maintenance are described and discussed. The subject of fuels, solid, liquid, and gaseous, including the devices in use for their economical combustion, receives attention. This is followed by a study of the construction and operation of the various forms of stationary engines. Compounding, governing, counterbalancing, the action of the fly-wheel, and the effects of the inertia of the reciprocating parts are treated in an elementary manner. The methods of action of the common forms of valves and valve gears are explained. The erection and general maintenance of engines are dealt with.

Visits of inspection to various machinery plants, in the neighborhood, are arranged in order to make the students familiar with the machines described. Wednesday afternoons must be kept free for this purpose.

The second half of the course is devoted to an elementary study of the science of thermodynamics and its applications to heat engines and the flow of fluids.

ENGINEERING 11*b*. — Steam Engine and Boilers. — General theory and design. — Valve gears and governors. Professor HOLLIS.

This course is intended primarily for students of Mechanical Engineering, but it is open to all students who are taking Course 5*a* and have passed satisfactorily in the first half of Course 11*a*. It cannot be counted towards the degree of A.B.

The course presupposes knowledge equivalent to that acquired in Course 11*a*. It takes up the general design of steam boilers and engines, leaving, however, the design of such parts as are proportioned especially for strength to be treated in Course 14*a*.

The subjects considered in this course include the determination of the necessary heating surface and grate area in boilers, the design of chim-

neys, the calculation of power developed in steam-engine cylinders, the proportioning of multi-cylinder engines, analysis of the action of the common valve gears, the methods of regulating the speed of an engine and of reducing the variations in rotative effort. These subjects are treated with sufficient completeness to enable the student to make intelligent design of the members concerned. Numerous problems in design are worked out by the students.

ENGINEERING 12*a*. — Efficiency and Economics of Engines and Boilers. Mr. L. S. MARKS.

This course is open to students who have passed satisfactorily in Courses 1*c* and 11*a*.

In this course heat engines and boilers are considered from the thermal standpoint. The sources of loss of efficiency are individually analyzed and the methods of reducing the losses, by compounding, jacketing, superheating, and by other means, are discussed. The effects of these losses on the cost of steam power and the considerations determining the choice of the type of steam engine to be used under any given conditions are dealt with. Gas and oil engines are similarly studied, and are compared with the steam engine.

Other topics which are taken up include the theory and performance of air-compressing and refrigerating machines, and steam turbines.

ENGINEERING 12*c*. — Heating and Ventilation of Buildings. Mr. BURKE.

This course cannot be counted toward the degree of A.B.

The heating and ventilation of buildings receives the treatment necessary to supplement instruction bearing on this topic given in other courses. Instruction in this course includes the consideration of forms of boilers for heating, with their seatings, the sizes and leads of pipes for the distribution of steam, hot water, and hot air; the positions and proportions of radiators, and, in general, the practical details of installing heating plants. The use of exhaust steam, and the hot blast system, in connection with the heating and ventilation of mills, factories and other large buildings, receives attention. Students are required to design heating and ventilation plants suitable for public buildings.

ENGINEERING 13*a*. — Engineering Laboratory. — General course in experimental methods. Mr. L. S. MARKS.

This course is open to students who take or have passed satisfactorily in Courses 5*a*, 6*a*, and 11*a*. It may be counted toward the degree of A.B. with the consent of the Chairman of the Department.

The principal objects of the course are to give instruction and practice in the measurement of some of the quantities with which the engineer has to deal, and to make the student acquainted practically with the methods and instruments used in carrying out engineering investigations.

The laboratory work includes the calibration of the various instruments, such as steam engine indicators, transmission and absorption dynamometers, thermometers and pressure guages; the determination of the efficiencies of hoisting gears, steam boilers, steam engines, pumps, gas engines, blowers, water wheels; the investigation of the efficiency of the transmission of power by ropes and belts; the measurement of the friction of journals and of the flow of water through orifices and over weirs; the testing of the strength of wrought iron, steel, cast iron, wood, stones, bricks and cements under tension, compression, bending, impact, and torsion. Practice is also given in flue gas analysis, in the use of steam calorimeters, and in valve setting.

ENGINEERING 13*b*. — Engineering Laboratory. — Advanced course in Experimental Engineering. Mr. L. S. MARKS.

This course is open to students who have passed satisfactorily in Course 13*a*, and are taking Course 12*a*. It cannot be counted toward the degree of A.B.

The work in this course consists of a series of investigations carried out by all the students and of a research on some special subject which may form the basis of, or may supplement, the student's thesis. The regular investigations include complete tests of a boiler, steam engines, gas engines, an air compressor, a blower, an injector and other machines. Some investigations are also made on the transmission and radiation of heat, on the strength of materials, and the transmission of power. Tests of power plants will be made as opportunity offers.

ENGINEERING 14*a*. — Machine Design. — Designing the parts of machinery. — Methods of proportioning the parts for strength and effect. Mr. MOSES.

This course is open to students who have passed satisfactorily in Course 3*d*, and who take or have taken Courses 5*a* and 11*a*. It may be counted toward the degree of A.B. with the consent of the chairman of the Department.

This course is intended to give practice in the design of simple machine details and some knowledge of the application of the principles of mechanics. Complete working drawings of machines and their details are made during the year; but the students are required to design a great many pieces of which only freehand sketches are kept. All of the latter

work is done in note-books, which are carefully examined by the instructor, in order that habits of neatness and system as well as accuracy may be learned.

Text-book: Low and Bevis's *Machine Design.*

Reference-books: Reuleux' *Constructor;* Kent's *Mechanical Engineer's Handbook.*

ENGINEERING 14*b*. — Machine Design. — Completed designs of machinery with estimates and specifications for contractors. Professor HOLLIS and Mr. BURKE.

This course is open to students who have passed satisfactorily in Course 14*a*. It cannot be counted towards the degree of A.B.

The designs of entire machines are undertaken in this course with instruction in the details of the steam engine and boiler. It is expected that every student shall complete the working drawings for all parts of a steam engine and, if time permits, of a steam boiler. Reference is freely made to all the books and drawings in the library, and the student is required to study out the designs himself with only such aid from the instructor as may avoid unnecessary delays.

ENGINEERING 16*c*. — Direct Current Dynamo-Electric Machinery. — Theory, testing and practice in management. Asst. Professor ADAMS and Mr. WHITING.

This course is open to students who have passed satisfactorily in the Mathematics and Physics prescribed for the first and second years of the course in Electrical Engineering.

The lectures begin with a review of the laws governing the flow of steady currents and the laws of electromagnetic induction. These laws are then applied in the study of electrical measuring instruments, electrical machinery, and apparatus of various kinds.

The work in the laboratory follows the same general outline as that of the lectures. Beginning with the simple measurements in electricity and magnetism, the student takes up a few experiments on the magnetic properties of iron and steel, and then the experimental study of direct current electrical machinery.

The tests of generators include measurements of resistance of armatures, fields, and insulation; observations of heating and sparking; the taking of characteristic, saturation, potential and efficiency curves; measurements of magnetic leakage and a study of armature reaction. Most of the above tests are common to both generators and motors, but in case of the latter, speed-characteristic and load curves are also taken.

* In many of these experiments the student predetermines the results as nearly as possible by theoretical calculation, and compares them with the observed results, tracing out the causes of error. After each experiment the student is required to write a detailed report of his work, clearly explaining the phenomena observed and the causes of any peculiarities. Throughout the course great stress is laid upon this part of the work.

* Occasional visits are made to the electric light and power plants, and to the manufactories of electrical machinery, in Boston and vicinity. During these visits the students are required to make a careful study of any novel points in the equipment, and afterwards to make a written report of the same.

Reference-books: S. P. Thompson's *Elementary Lessons in Electricity and Magnetism;* S. P. Thompson's *Dynamo-Electric Machinery;* Jackson's *Electro-magnet and Dynamo Construction;* Ewing's *Magnetic Properties of Iron and other Metals;* Houston and Kennelly's *Electro-Dynamic Machinery.*

ENGINEERING 16*d*. — Continuous and Alternating Machinery. — Continuation of Courses 16*c* and 16*e*, with practice in design and construction. Asst. Professor ADAMS and Mr. WHITING.

This course is open to students who have passed satisfactorily in Courses 16*c* and 16*e*. It cannot be counted toward the degree of A.B.

This course is intended primarily for students in Electrical Engineering, and is given in the fourth year of their prescribed work.

The work of this course is chiefly in the laboratory, supplemented by occasional lectures and conferences. The students are thrown as much as possible upon their own responsibility, and each one takes up some particular line of investigation, or the design of a piece of electrical machinery, or of an electrical plant. Occasionally two or three students take up together the study of some existing plant, making tests of the plant as a whole, or of particular parts which may be available for that purpose, and in every case a careful report is required.

At the conferences the students meet the instructors, report the progress of their work, and discuss any difficulties that may arise. In this way each student derives benefit from the work done by the others.

ENGINEERING 16*e*. — Alternate Currents and Alternating Current Machinery. — Theory and testing. Asst. Professor ADAMS and Mr. WHITING.

This course is open to students who have passed satisfactorily Course 16*c*.

This course follows Course 16*c*, and takes up the study of alternating current apparatus in a manner similar to that in which Course 16*c* takes up the study of direct current apparatus.

* Starred paragraphs under Course 16c apply to Course 16*e*.

The lectures begin with a study of the flow of alternating currents and the effects of inductance, capacity, and frequency, and then take up the generation, measurement, transformation, transmission, and utilization of such currents.

In the laboratory, the first series of experiments is designed to familiarize the student with the effects of inductance and capacity in alternating current circuits, with the methods of measuring these quantities, and with the magnitudes of their practical units. Then follow experiments on alternators, transformers, and alternating current motors, some of the more important of which are: —

The taking of characteristic, efficiency, and saturation curves of alternators; measurements of armature inductance and armature reaction; observations of the operation of synchronous motors with curves showing the limit of stability, and experiments showing the effect of armature resistance and inductance upon the same; the taking of speed characteristic, efficiency, power factor, and other curves from induction motors; experiments showing the influence of armature resistance and inductance upon the speed characteristics and outputs of induction motors; regulation and efficiency of transformers with separation of losses; current and E. M. F. curves from transformers.

Reference-books: C. P. Steinmetz's *Alternating Current Phenomena;* Gisbert Kapp's *Electric Transmission of Energy;* Gisbert Kapp's *Transformers;* D. C. Jackson's *Alternating Currents and Alternating Current Machinery.*

ENGINEERING 17*a*. — The Electrical Transmission and Distribution of Power. Asst. Professor ADAMS.

This course is open to students who have passed satifactorily in Courses 16*c* and 16*e*. It cannot be counted towards the degree of A.B.

The outline of the lectures is as follows: review of the different means of utilizing Electrical Energy; discussion of the several systems for transmitting and distributing electrical energy for the following uses: — for electric lighting from central stations and from isolated plants; to operate street railways; to operate suburban and main lines of steam railroads; to operate shops, factories, mills, printing machinery, elevators, farm machinery, pumps, etc.; to operate mining machinery; for electrometallurgy; for welding and forging.

As the student is by this time familiar with the generators, motors, and much other apparatus available for the above uses, the discussion is largely from the commercial and economical standpoint, an important feature being the design and construction of transmitting and distributing lines. Frequent visits will be made to some of the numerous plants in New

England, and in each case a careful study will be made of the station, line, and protective and regulating devices.

Reference-books: Abbott's *Electrical Transmission of Energy;* Crocker's *Electric Lighting;* Bell's *Power Transmission.*

ENGINEERING 18*a*. — Metallurgy. — Manufacture and physical properties of the metals used in engineering construction. — Lectures on the practical working of iron and steel. Mr. BURKE.

This course is intended primarily for the students of Civil and Mechanical Engineering, but it may be taken by others. It cannot be counted toward the degree of A.B.

The instruction relates mainly to Iron and Steel, and is intended to supply the student with a thorough knowledge of the metals he will have to use in his professional work. It precedes the instruction in the Resistance of Materials, and consists of a full course of lectures on the manufacture of iron and steel, together with their handling in the foundry, forge shops, and rolling mill. Numerous specimens, showing various stages of the processes treated, are used, and, whenever possible, visits are made to the workshops within reach of Cambridge.

ENGINEERING 21. — Engineering Conference on the general theory of machinery and the commercial and economic questions involved in the selection of types of machinery for given localities and duties. — Comparison of different methods of transmitting power. Professor HOLLIS.

This course is intended primarily for Fourth-Year students in all branches of Engineering. It cannot be counted towards the degree of A.B.

The course is conducted mainly by the students, and deals with current problems in Engineering, referring freely to transactions of engineering societies and to the periodicals. See note under Thesis.

ENGINEERING 22. — Contracts and Specifications. — The principles of Common Law as applied to Contracts. — Practice in drawing up specifications. Mr. WESTENGARD.

The course cannot be counted towards the degree of A.B.

It consists of about fifteen lectures on law, with practice in drawing up contracts and specifications for various projects.

THESIS.

The subject for a thesis should be selected by the student at the end of his Third-Year. It must involve considerations which will assist in his professional education. Sufficient time is given during the Fourth-Year for experimental investigation and visits to engineering establishments in connection with the thesis, a copy of which must be left with the Department for future reference. If the work done by the student in Course 21 is of high character it may satisfy the requirement of a thesis.

PHYSICS.

PHYSICS *B*. — Experimental Physics. Professor HALL and Mr. FISKE.

The laboratory exercises of Course *B* will be given in the morning hours, in most cases from 9 to 11 or from 11 to 1.

Course *B* is substantially equivalent to the second alternative in the Elementary Physical Science of the requirements for admission. It is open to students who have not passed in this requisition or taken in College any Course in Experimental Physics.

The object of this course is to enable every student to obtain practical acquaintance with laboratory methods of work and with those elementary facts and laws which are the foundation of the science of Physics. It is for those who have done little or no laboratory work in Physics before coming to College, and is the natural introduction to Courses *C* and 1. Students are advised to take it in the Freshman or the Sophomore year. The book used is Hall and Bergen's *Text-book of Physics*, Holt & Co.

PHYSICS *C*. — Experimental Physics. — Mechanics, Sound, Light, Electricity, and Magnetism. Asst. Professor SABINE and Mr. ——.

Course *C* is substantially equivalent to the Advanced Physics of the requirements for admission. It is intended for those who wish to give especial attention to methods of physical measurement in preparation for higher courses in Physics, Chemistry, or Engineering. The course is open to those students only who have presented Elementary Laboratory Physics for admission, or have taken Physics *B* or its equivalent.

The manual used as a guide in the laboratory work is Sabine's *Laboratory Course in Physics*, Ginn & Co.

PHYSICS 1. — General Descriptive Physics. Professor HALL and Mr. ——.

Course 1 is intended for students who wish to become acquainted with a wide range of physical phenomena and with the means for exhibiting

and applying such phenomena. It is regularly open to students who have taken Course *B* or who have passed in the second alternative of the Elementary Physics for admission, but may be taken by others who satisfy the instructor of their fitness to profit by the course.

Course 1 is naturally taken by students who do not intend to take any higher course in Physics.

The text-book commonly used is Everett's edition of Deschanel's *Natural Philosophy*, Appleton & Co.

PHYSICS 3. — Electrostatics, Electrokinematics and parts of Electromagnetism. Professor B. O. PEIRCE and Mr. ——.

Course 3 is adapted to students who take or have taken Mathematics 2 or its equivalent, and should be preceded by Course *C* or 1.

The course consists of a lecture or recitation every Tuesday, with from six to eight hours of laboratory work per week. In the laboratory the student is expected to learn to make accurate absolute or relative measurements of current strength, resistance, electromotive force, quantity, and capacity. In the second half of the year such a knowledge of the principles of the Differential and Integral Calculus will be assumed as students who are then taking Mathematics 2 should have.

Students who elect this course are asked to provide themselves with S. P. Thompson's *Lessons in Electricity and Magnetism*, Part 2 of the *Physical Laboratory Notes of the Massachusetts Institute of Technology*, Day's *Examples in Electricity and Magnetism*, and a pamphlet published by the University containing a description of certain preliminary experiments in Magnetism. References will be made to other books to be found reserved in Gore Hall.

PHYSICS 4. — Electrodynamics, Magnetism, and Electromagnetism. Professor TROWBRIDGE, Asst. Professor SABINE, and Mr. COLPITTS.

Course 4 is intended for students who have taken Mathematics 2, or its equivalent, and Physics 3.

This course consists of lectures, recitations and laboratory work. During the first half of the year, the subject of Magnetism and Electromagnetism is treated in lectures with copious references to Wiedmann's *Galvanismus*, and to the unmathematical portions of Maxwell's *Electricity*. During the second half of the year the student is expected to employ the principles of the Differential and Integral Calculus. Some of the mathematical portions of Maxwell's and Mascart's treatises will be referred to, and Fleming's treatise on *Induction and Alternate Transformers* and Ewing's treatise on *Magnetic Induction in Iron and Other Metals* will be used as text-books.

The laboratory work embraces the standard tests of the magnetic quality of iron, the various methods of measuring coefficients of self induction and mutual induction with reversed and with rapidly alternating currents, and other experiments with rapidly alternating currents of low intensity.

Courses 3 and 4 together are intended to cover the subjects of Magnetism and Electricity, and to give a suitable foundation for students who propose to study Electrical Engineering or the higher branches of Electrical Science.

PHYSICS 8. — Electromagnetism with especial reference to Periodic Currents. Professor TROWBRIDGE.

This course is intended for Graduate Students; but is open to students who have taken Course 4 and who have no other laboratory course.

PHYSICS 9. — Portions of the Mathematical Theory of Electricity and Magnetism. Professor B. O. PEIRCE.

Omitted in 1898–99.

Mathematics 10 (Fourier's series, Spherical Harmonics and Allied Functions), or its equivalent, will be required as a preparation for Course 9.

Course 9 will use as text-books: Maxwell, *A Treatise on Electricity and Magnetism*, Oxford, Clarendon Press; Webster, *The Theory of Electricity and Magnetism*, Macmillan; Mascart & Joubert, *A Treatise on Electricity and Magnetism*, London, De La Rue & Co.; Gray, *Absolute Measurements in Electricity and Magnetism*, Macmillan; J. J. Thomson, *Recent Researches in Electricity and Magnetism*, Macmillan; *Heaviside's Papers*, Macmillan; Duhem, *Electricité*, Gauthier-Villars.

CHEMISTRY.

CHEMISTRY 1. — Descriptive Inorganic Chemistry. Professor JACKSON, Mr. FULLER, and three assistants.

In this course each student has each week two lectures on Monday and Friday at 12 in Boylston 7, and either four hours of laboratory work or, more commonly, two hours of laboratory work and one of recitation. For laboratory and recitation work there are two divisions (to avoid conflicts), — the first on Tuesday and Thursday from 1.30 to 3.30, the second on Wednesday and Friday from 2.30 to 4.30. The recitations (one hour) come at 1.30 on Thursday for the first division, at 2.30 on Friday for the second, and when they are held no laboratory work is required on these days. Recitations in Boylston 7; laboratory exercises in Boylston 13 or A.

No previous chemical training is required for Chemistry 1, but more advantage will be gained from this course if the student has some knowledge

of the general principles of chemistry, such as that given in Course *B*, or in the chemistry required for entrance to College. The course deals with the preparation, properties, and uses of the more important elements and inorganic compounds. The lectures are illustrated by experiments and diagrams, and in the laboratory those experiments are performed which are not well adapted to the lecture-room. There is no text-book. A pamphlet entitled *Laboratory Experiments in Chemistry 1* is essential; another, *Synopsis of Lectures in Chemistry 1*, is useful, but not essential.

The course trains the memory, the powers of inductive reasoning, the faculties of observation, and of manipulation. It gives a knowledge of inorganic chemistry sufficient for all the ordinary uses of life, even for men engaged in a scientific profession. It carries systematic instruction in inorganic chemistry as far as is desirable; if a man wishes a fuller knowledge of the subject, he can obtain it by study of the larger text-books much more advantageously than by an additional course of lectures.

This is one of the courses required of all students in the Scientific School (except those in Architecture) and for admission to the Medical School. It is also an essential preparation for all the courses which follow.

CHEMISTRY 2. — Organic Chemistry (Elementary Course). Dr. TORREY.

In this course a student has three lectures a week during the first half-year. The object is to give a general idea of the chemistry of the compounds of carbon. With Course 1 it presents a general survey of elementary chemistry. It serves as a preparation for the much more extended course on the same subject (Course 5), and students who can afford the time are strongly advised to use it in this way, but it is not required for Chemistry 5. It is intended, also, for students of Biology, and for those who are preparing to enter the Medical School, and the portions of organic chemistry treated will be selected with a special view to the needs of such students.

CHEMISTRY 3. — Qualitative Analysis. Mr. SYLVESTER, Mr. DOW, and two assistants.

To be admitted to this course the student must have passed Chemistry 1, or have taken a course of descriptive chemistry equivalent to it.

The amount of laboratory work given in this course will occupy an average worker nine hours each week, three of which must come at the hours given in the programme. During the last two years the class was so large that a second division at different hours was arranged for the required three hours of laboratory work, but not for the lectures. The remaining six (or more) hours can come at any time most convenient to the student. At the three required hours the exercises occassionally con-

sist of lectures instead of laboratory work, but there is no work required outside of the laboratory and lecture-room. The text-book is Hill's *Lecture Notes on Qualitative Analysis.*

This course trains the student to draw correct inferences in regard to the compositon of substances from a carefully arranged sequence of experiments. It has therefore great educational value, and is also an essential preparation for the more advanced chemical courses. After the analysis of the large number of substances required in this course, the student has a training in qualitative analysis sufficient for all purposes.

It is required for admission to the Harvard Medical School, and students who pass satisfactorily in Chemistry 1 and 3 are admitted without examination in chemistry. It also forms part of the Scientific School courses in Mining Engineering, Botany and Zoölogy, Science for Teachers, and Anatomy and Physiology.

CHEMISTRY 4. — Quantitative Analysis. Mr. BAXTER.

To enter this course the student must have passed in Chemistry 1 and 3, or courses in the same subjects equivalent to these. Students are allowed, however, to take Chemistry 3 and 4 together in the same year. The work in this course is expected to occupy nine or more hours each week, all in the laboratory; three of these hours must come at the times mentioned in the programme, the remaining work can be done at any time most convenient to the student. The regular hours are occasionally occupied by lectures.

The object of this course is to teach the methods of determining the amounts of each constituent in a substance. It gives a general survey of the more important methods, both gravimetric and volumetric. It has less general educational value than many of the other chemical courses, but is the foundation of all advanced chemical work, and therefore essential to those going further in the subject. It also trains the student especially in skill, care, and accuracy, and would therefore be useful, but not essential, to those who intend to study medicine or certain branches of natural history.

The labortory for quantitative analysis is supplied with filter-pumps, steam evaporators, electrolytic apparatus, and other modern appliances. The number of balances in the adjoining room is so large that each is assigned to not more than four men.

CHEMISTRY 5. — The Carbon Compounds. Professor H. B. HILL and Mr. WHEELER.

To enter this course the student must have passed Chemistry 1. or an equivalent course in the same subject; but, although students who have studied only Chemistry 1 are admitted, it is advisable to have a fuller knowledge of Chemistry (3 and 4) before entering this course. The hours

named in the programme are occupied by lectures (three each week), and there is required also an amount of work in the laboratory which occupies six hours with an average man. In the lectures a systematic course of organic chemistry is given treating the subject principally from the theoretical side, for, although the applications of the science are described briefly, most of the time is devoted to the description of the preparation and properties of the general groups, and to the elucidation of the structure of the molecules of organic substances, with the methods by which problems relating to the organic constitution are solved. In the laboratory the time is devoted to the methods of organic analysis, and to the preparation of organic compounds. As a general rule the laboratory work of each man is different from that of his fellows, and may be varied to suit his needs or intentions. Students are sometimes allowed to count Chemistry 5 as two courses by giving a larger amount of time to laboratory work, but to do this the consent of the instructor and of the Administrative Board must be obtained. A reading knowledge of German is useful, but not required in this course.

This course, in additon to cultivating the faculties trained by the other chemical courses, gives practice in reasoning, and in the correlation of a large number of facts by referring them to general principles. It gives a comprehensive knowledge of organic chemistry, and takes the student as far as is worth while by lectures. Students who wish to pursue the subject further would devote themselves to special lines of study in the chemical journals. It is the essential preparation for research in organic chemistry, and is earnestly recommended to all who intend to make a speciality of chemistry. Candidates for Honors in Chemistry must pass this course. It is useful but not essential to those who intend to study medicine or biology.

The laboratory occupied by the students in Chemistry 5 is fitted with gas, water, steam, and a filter-pump at each desk. The hoods are large and powerful; a sunlight table is provided for work which needs this agent; and attached to the laboratory are a balance-room, a room with the two combustion furnaces, and a room for sealed tube work.

CHEMISTRY 6. — Physical Chemistry. Asst. Professor RICHARDS and Mr. ——.

The students taking this course are required to have passed in the following courses or their equivalents: Physics 1 (or *C*), Mathematics *A* and *B*, or Engineering 1*a*, 1*b*, and 1*d*, Chemistry 4 and 8. A knowledge of calculus (Mathematics 2) and of thermo-dynamics (Physics 6) is also very desirable.

The instruction is given by lectures at the hours mentioned in the programme and by laboratory work. In the lectures a complete survey

of the subject will be given, including the relations of mass and volume, thermo-chemistry, chemistry of solutions, electro-chemistry, and optical chemistry. The laboratory work, which will be arranged to occupy an average man six hours a week, will consist of the study of physical chemistry as related to the subject-matter of the lectures, and will include among similar subjects the determination of the specific gravity of solids, liquids, vapors, and gases; calorimetry; the use of the spectroscope, and the refractometer; boiling and freezing point determinations; and the study of conductivity of electrolytes.

Text-book: Ostwald, *Physico Chemical Measurements* (translated by Walker).

Books of Reference: Nernst, *Theoretische Chemie;* Ostwald, *Grundriss* and *Lehrbuch;* Le Blanc, *Electro-Chemistry* (translanted by Whitney); Lübke, *Electro-Chemie.*

A reading knowledge of German is essential in this course.

In addition to the educational value found in the other chemical courses, this gives a certain amount of mathematical practice. It is essential for those who take the research course in physical chemistry, and is recommended to all advanced students in Chemistry. Candidates for Honors in Chemistry must pass this course.

CHEMISTRY 8. — History of Chemistry, and Chemical Theory. Asst. Professor RICHARDS.

This course is required for Honors in Chemistry and for Chemistry 6. It can be taken only by those who have passed in Chemistry 1 and 2, or are taking 5. It consists of lectures upon the history of the science, tracing it from the earliest times to the present day, and dwelling especially on the modern chemical theories. This course should be taken by all who intend to make an extended study of chemistry, for the very elementary knowledge of the theory of chemistry given in Chemistry *B* and 1 is inadequate for an advanced student. No text-book is required, but the following works will be found useful as books of reference: E. von Meyer, *History of Chemistry* (translated by McGowan); Ostwald, *Grundriss* (translated by Walker); Lothar Meyer, *Grundzüge;* and *Modern Theories* (translated by Bedson and Williams); Würtz, *Atomic Theory;* and Scott, *Introduction to Chemical Theory.* A reading knowledge of German is useful, but not essential in this course.

CHEMISTRY 9. — Advanced Quantitative Analysis. Asst. Professor RICHARDS.

CHEMISTRY 10. — Gas Analysis. Asst. Professor RICHARDS.

The object of these courses is to give the student a fuller knowledge of the more important processes of quantitative analysis. They deal, there-

fore, with special methods of analysis in the laboratory, but the whole field is covered by lectures. The laboratory work in 9 usually includes the preparation of pure salts, analysis of minerals, iron, waters, and sugar, but may be varied to suit special needs or intentions on the part of the student. Course 10 deals with the analysis of air, furnace gases, and illuminating gas, nitrometer manipulation, and other problems of this kind. These courses are intended for those who mean to make a specialty of chemistry, and while useful for all of these, are essential for those who mean to take the course in inorganic research. The laboratory for these courses is the same as that used for Chemistry 4.

Research Courses.

A mastery of the following subjects is necessary for all who take research courses: Descriptive Chemistry (Chemistry 1), Organic Chemistry (Chemistry 2), Mineralogy (Mineralogy 2), Qualitative Analysis (Chemistry 3), Quantitative Analysis (Chemistry 4), and Theoretical Chemistry (Chemistry 8). In addition to this general chemical training, special preparation must be made for the research course, taken as follows: For Inorganic Chemistry, Chemistry 9 and 10; for Organic Chemistry, Chemistry 5; for Physical Chemistry, Chemistry 6. Equivalent courses in the same subjects are accepted in place of the elective studies in Harvard College.

Each student is earnestly advised to pursue as many of these special studies (9, 10, 5, and 6) as possible, in addition to those necessary as direct preparation for his special line of research, since an organic chemist, for example, will take a broader view of the subject, and thus make a better specialist, if he has an elementary knowledge of advanced quantitative analysis and physical chemistry. A reading knowledge of German and French is required for these courses. To get the most advantage from a research course, the student should devote all his time to it. If this is impossible, he should not undertake one of these courses unless he can give at least half his time to it. No one is allowed to take two research courses in a single year. In every case the professor must be consulted before the course is taken.

Instruction is offered in the following special lines of research:

20*a*. Inorganic Chemistry by Asst. Professor Richards.
20*b*. Organic Chemistry by Professor Jackson.
20*c*. Organic Chemistry by Professor Hill.
20*d*. Physical Chemistry by Asst. Professor Richards.

Arrangements will be made, if possible, to give instruction to students wishing to pursue lines of research not included in these special departments.

CHEMISTRY 20*a*. — Inorganic Chemistry. Asst. Professor RICHARDS.

The work in this course has consisted heretofore in (1) The revision of atomic weights; (2) The preparation of new compounds; (3) The separation and study of the salts of the rare elements; (4) Study of the methods of quantitative analysis. Each student selects from these lines of work that for which he is best fitted.

The laboratory for research in Inorganic Chemistry provides ample desk-room for each student, and is furnished with gas, water, steam and filter pumps. Excellent facilities are provided for electrolytic work. For the revision of atomic weights there are special balances, and every provision is made for the most refined and delicate work.

CHEMISTRY 20*b*, or 20*c*. — Organic Chemistry. Professor JACKSON, or Professor HILL.

The courses of the two professors are entirely distinct, and the student must select the course which he proposes to follow. The student works in the laboratory for organic chemistry described under Chemistry 5 (see p. 135). The desk-room allowed each man is ample, and the facilities for research are of the best.

CHEMISTRY 20*d*. — Physical Chemistry. Asst. Professor RICHARDS.

The Laboratory is provided with the usual instruments of research in physical chemistry; and the work in this course may take any one of the following directions: (1) Electro-chemistry; (2) Thermo-chemistry; (3) Spectroscopy; (4) Problems in equilibrium. Work in other lines than these could also be arranged, if desired. Each student selects from these the work for which he is best fitted. A knowledge of calculus (Mathematics 2) and of Thermodynamics (Physics 6) is essential for most of these lines of work; a more advanced knowledge of mathematics and physics is desirable. Work in Boylston Hall may be advantageously combined with work in the admirably equipped Jefferson Physical Laboratory.

BOTANY.

BOTANY 1. — General introductory course. Professor GOODALE and Mr. OLIVE.

This course is required as an introduction to Courses 3, 4, and 5. It is intended for beginners and for those who wish to get a comprehensive view of the subject.

The lectures cover the principal topics in General Botany, the structure, functions, and habits, especially of flowering plants, their classification, distribution, adaptations, and uses. The relations of the subject to evolution are presented, and, as far as possible, illustrated by preparations and living specimens. The plants cultivated at the Botanic Garden of the University are at the service of this elective course, and afford ample

material for demonstrations. These resources are supplemented by the specimens in the Botanical Museum. The supply of native plants for laboratory practice comes from the Bussey Institution. The practical work in this course is conducted in small sections under the direct supervision of trained laboratory assistants, who endeavor to familiarize every student with the principles underlying the identification and description of species, and the preservation of botanical specimens.

BOTANY 2. — Morphology of Plants. Asst. Professor THAXTER.

This course cannot be taken separately from Zoölogy 2. Exceptions from this rule will be allowed only after written application has been made to, and consent received from, the instructors in Zoölogy 1 and 2, and Botany 2. The number of students in the course being necessarily limited, preference will be given to those who intend to take Botany 4, Zoölogy 3, 4, Geology 13, 15, or to study medicine.

The aim of Botany 2 and Zoölogy 2 is to afford the necessary elementary training for those who desire to continue the study of some branch of Biology and should be taken preferably in the sophomore year, as a preparation for the more advanced electives. Botany 1 is not required as a preparation for Botany 2, but should if possible precede it.

The course is given on Mondays, Wednesdays, and Fridays during the first half-year, after which it is succeeded by Zoölogy 2. Two or three lectures are given every week in addition to which a minimum of six hours of laboratory work is required to be performed on the days specified, on each of which days students should, if possible, arrange to spend two *consecutive* hours. The laboratory work involves the constant use of the compound microscope, in connection with which are taught the simpler methods of sectioning and staining microscopic preparations, twenty-four of which are required to be handed in for examination together with the laboratory note books at the end of the course: while the objects examined and drawn are designed to illustrate the morphology and reproduction of certain more important types throughout the vegetable kingdom. The lectures embrace a comprehensive review of the morphology and development of plants and their types of reproduction, special attention being given to the lower plants or Thallophytes, including the Bacteria.

BOTANY 3. — Morphology, Histology (with special reference to the technique of the microscope), and Physiology of Flowering Plants. Laboratory practice with lectures and demonstrations. Professor GOODALE and Mr. OLIVE.

Course 3 is open to those only who have taken Course 1.

The first half-year is devoted to the study of the microscopic structure of Flowering plants and Ferns, and their allies. As far as is possible, a

comparative study is made of the tissues and their combinations in the various groups, and the development of tissues and organs is traced by actual inspection from the lower to the higher groups. In this division of the work, special attention is paid to the technique of microscopic research. The principal methods of killing, hardening, imbedding, and cutting vegetable tissues are taken up in detail. Application of these methods is made by each student in the series of microscopic slides prepared by him during the first half-year. Towards the close of this division of the work, considerable time is given to the subject of cell-multiplication and the changes which take place during the growth of parts.

In the second half-year, the work comprises an investigation of the principles which are accepted in Vegetable Physiology. The experimental study is carried on at the laboratories of the Botanic Garden. Much attention is devoted to the subject of adaptation of plants to their surroundings. The greenhouses and garden provide abundant material for these experiments and observations.

BOTANY 4. — Cryptogamic Botany. — Lectures and laboratory work. Asst. Professor THAXTER.

This course, which is only open to students who have taken Botany 1 and 2, is designed as a sequel to Botany 2. Two or three lectures are given a week in addition to which a minimum of six hours laboratory work a week is required. It has been the general policy hitherto pursued with reference to this course, to vary the subject matter from year to year both as regards the lectures and the laboratory work, giving special attention to the lower or to the higher cryptogams respectively. The course is designed as a foundation for more special work in Botany 20*b*, as well as to afford to students intending to study medicine or to teach general cryptogamic botany in high schools or colleges an opportunity for acquiring a knowledge of the lower plants sufficient for their purposes.

BOTANY 5. — Systematic and Economic Botany. Professor GOODALE.

This course, open to those who have taken Courses 1, 2, and 3, or their equivalents, has been established with special reference to those who desire to give attention to Systematic Botany. The work consists of practice in botanical description and delineation, and in the study of affinities. The Botanic Garden is freely drawn upon for material, and this material, when necessary, is supplemented by the collections of dried plants in the Botanical Museum. There is in the laboratory a small Herbarium for comparisons.

The economic part of the course considers the more important useful plants and their products.

The lectures deal with the history of Botanical Classification, and the relations of the respective systems to contemporary systems.

Attention is paid in this course to approved methods of collecting and preserving botanical specimens.

BOTANY 20*a*. — Structure and Development of Phanerogams — Experimental Vegetable Physiology. — Systematic Botany (Phanerogams). — Economic and Medical Botany. Professor GOODALE.

Only those who have taken Botanical Courses 1, 2, 3, 4, and 5, or their equivalents, are permitted to enter on this course. With the advice of the instructor, students select some special topic in one of the branches of botanical research above specified, and carry on their work independently, reporting their results from time to time. In addition to the facilities afforded for the pursuit of Systematic Botany in the Laboratories, the collections at the Gray Herbarium are open to properly qualified students who confer with the Curator.

BOTANY 20*b*. — Structure and Development of Cryptogams. Asst. Professor THAXTER.

This course is intended for the preparation for and prosecution of original research on the subject. The work requires considerable time, and is adapted to students who have reached a stage of their studies where they can with profit attempt special work, having in view the preparation of an original paper on some subject.

ZOÖLOGY.

ZOÖLOGY 1. — Zoölogy. — Lectures and laboratory demonstrations. Dr. C. B. DAVENPORT, Mr. S. R. WILLIAMS and other assistants.

This course is designed to give a general survey of the whole field of Zoölogy. At the beginning, the structure and activities of the simplest organisms are considered, and then the laws of distribution of animals in space and time, the evolution of the general form, structure, and activities of animals, and the laws of evolution. In Morphology such topics are discussed as the origin of asymmetry and of the metameric condition in animals and the evolution of organs and tissues. In Physiology are discussed: locomotion, response, nutrition, growth, and development of

the individual; the origin of the complicated functions of organs from the simplest condition is also treated of. In considering the laws of evolution certain general topics are taken up; such as, the care of the young, parasitism, symbiosis, coloration, variation, and heredity.

The laboratory work consists of a study of animals selected to illustrate the topics treated of in the lectures.

There are at least two lectures a week, on Tuesdays and Thursdays at 10 o'clock. If there are additional lectures, they occur at the same hour on Saturdays. The laboratory demonstrations require three hours a week, and must be pursued on Tuesdays, Thursdays, or Saturdays.

There are no recitations in this course.

ZOÖLOGY 2. — Morphology of Animals. — Lectures and laboratory work. Drs. G. H. PARKER and CASTLE, Mr. PRENTISS and a second assistant.

This course cannot be taken separately from Botany 2. Exceptions from this rule will be allowed only after written application has been made to, and consent received from, the instructors in Zoölogy 1 and 2 and Botany 2.

This course is open to those only who have taken Zoölogy 1. The number of students in the course is necessarily limited, and preference will therefore be given to those who intend to take more advanced courses in Zoölogy, Botany 4, or Geology 14 and 15, or to study Medicine.

The aim of Zoölogy 2 and Botany 2 is to afford the necessary elementary training for those who desire to continue the study of some branch of Natural History, either in the later years of college life or after graduation. Since it is required as a preparation for several other electives, it should be taken early in the college course; if possible, not later than the Sophomore year; it may be taken, under suitable restrictions, even in the same year with Zoölogy 1.

The lectures in this course are given on Wednesdays and Fridays and occasionally Mondays. The lectures are on the morphology of the more important types of animals; those on a given group follow immediately the corresponding laboratory work, which consists in the dissection of representatives of the types selected. Each student is expected to spend six hours a week in the laboratory, and the hours may be arranged by consultation with the instructor, but they must be on the days named.

ZOÖLOGY 3. — Comparative Anatomy of Vertebrates. — Lectures, laboratory work and reports. Dr. G. H. PARKER and Mr. FRANDSEN.

Course 3 is open to those only who have taken Courses 1 and 2 and Botany 2.

This course is intended for those who are particularly interested in Zoölogy, and also for those who wish to lay a broad foundation for their subsequent study of human anatomy as medical students.

Lectures are given at 9 o'clock on Tuesdays and Thursdays, and, at the option of the instructor, a demonstration or other informal exercise on Saturdays. In the lectures special attention is given to evidences of progressive modifications in the structure of the organs of vertebrates as exhibited in passing from lower to higher groups.

The laboratory work requires at least six hours a week.

ZOÖLOGY 4. — Microscopical Anatomy. — Lectures and laboratory work. Dr. W. E. CASTLE and Mr. W. H. RAND.

Course 4 is preparatory to Courses 5 and 20*a*. It is open to those only who have taken Course 2, and may be taken advantageously either *after* or with Course 3. It is for those who intend to prepare themselves for making special investigations, either as teachers of Zoölogy, or as physicians. It presupposes an elementary knowledge of animal morphology, and familiarity with the use of the microscope. As the number of students who can be accommodated is small, preference will be given to those preparing to take Course 5 or 20*a*.

In this course instruction is given in methods of investigation. There will be two, or, at the option of the instructor, three lectures a week. The laboratory work should be arranged for the morning hours of Mondays, Wednesdays, and Fridays.

The instructors are to be consulted before electing the course.

ZOÖLOGY 5. — Embryology of Vertebrates. — Lectures and laboratory work. Dr. W. E. CASTLE and Mr. W. H. RAND.

Course 5 is open to those only who have taken Course 4.

The lectures in this course are on the Embryology of Vertebrates. The laboratory work consists in the preparation and study of the chick and other vertebrates at successive stages of development.

ZOÖLOGY 9. — Fossil Invertebrates. — Lectures and laboratory work. Dr. R. T. JACKSON.

Course 9 requires Course 1 and Geology 4, or their equivalents, as preparation, and Course 2 and Geology 5 are strongly recommended.

This course is intended to give in zoölogical sequence an acquaintance with the geological history of Invertebrates. It considers the structure and development of representative fossil types and their systematic relations to one another and to recent allies. Attention is given to phylo-

genetic relations as expressed in the development of the individual and in systematic series. The geological occurrence of each group of animals and their relative importance as rock builders are considered. Especial attention is given to laboratory work.

ZOÖLOGY 10. — Experimental Morphology. — Ontogenesis studied as a process. — Lectures, laboratory work, and a thesis. Dr. C. B. DAVENPORT.

Courses 10 and 11 are open to those only who have taken Course 2, and may be taken advantageously either *after* or with Course 3. These courses are regularly given in alternate years; they are not dependent upon each other, and therefore may be taken in either sequence.

Course 10 is intended for those who desire to pay particular attention to the physiological process of the development of the individual. The lectures treat of the effect of chemical and physical agents upon the following four classes of activities involved in ontogenesis: 1, general functions of protoplasm; 2, growth; 3, cell division; 4, differentiation. In treating each topic stress is laid upon the historical development of our knowledge and the methods employed in investigation. A nearly complete bibliography of each subject is given.

In the laboratory work of Courses 10 and 11, experimental or statistical problems in ontogenesis or phylogenesis are investigated and the results embodied in a thesis.

These courses require at least such a knowledge of the structure of animals and plants as is gained in Course 2 and Botany 2, and a knowledge of microscopic technique will be found of advantage, although not necessary.

ZOÖLOGY 11. — Experimental Morphology. — Phylogenesis studied as a process. — Lectures, laboratory work, and a thesis. Dr. C. B. DAVENPORT.

This course is intended for those who desire to pay attention to the physiological process of the development of the race. The lectures lay especial stress upon the statistical and experimental study of variation. In succession are studied: Individual variation, sports, and correlated variation; normal heridity and results of crossing; and selection. In conclusion a critical examination of the different theories of phylogenesis is made.

For a statement concerning laboratory work and preparation required for the course, see under Course 10.

ZOÖLOGY 15. — The Nervous System and its Terminal Organs. — Sense Organs. — Lectures and reports. Dr. G. H. PARKER.

ZOÖLOGY 16. — The Nervous System and its Terminal Organs. — Central Nervous Organs and Terminal Organs of Efferent Nerves. — Lectures and reports. Dr. G. H. PARKER.

Courses 15 and 16 are designed primarily for those who intend to make a special study of the nervous system and its terminal organs in connection with zoölogical, medical, or psychological work.

These courses are regularly given in alternate years. They should ordinarily be preceded by Course 3, and are open to those only who have taken Course 2. They are independent of each other and may be taken in either sequence. In both courses each student will be given a special topic for collateral study, the results of which are to be presented at the end of the course in the form of a written report.

ZOÖLOGY 20*a*. — Anatomy and Development of Vertebrates and Invertebrates. Drs. C. B. DAVENPORT, G. H. PARKER, and W. E. CASTLE.

This course is designed for those only who are competent, with the aid of the instructor, to carry on some original investigation. Each student selects, with the advice of the instructor, the subject of his research, and the results are embodied in a thesis. The investigations of advanced students, when considered worthy of publication, usually appear in the Bulletin of the University Museum.

Persons contemplating this work will find it to their advantage to consult the instructor at an early date, — if possible, as early as the first of April of the preceding academic year.

The Zoölogical Club.

The instructors and advanced students in Zoölogy hold weekly meetings for the presentation and discussion of original work and the review of current zoological literature.

GEOLOGY.

GEOLOGY 4. — Elementary Geology. — Lectures, with collateral reading. Professor SHALER, assisted by Mr. WOODMAN.

This course gives a general knowledge of Geology which may serve either as an outline of this branch of Natural History for those whose main line of study is in other directions, or as a basis for further geological work for those who intend to devote themselves to Geology. (See Geology 5, below.)

Voluntary field excursions in the autumn and spring are offered to those taking this course.

GEOLOGY 5. — Elementary Field and Laboratory Geology. Mr. J. B. WOODWORTH, assisted by Messrs. WOODMAN and ——.

Course 5 may be taken only with or after Course 4. Courses 4 and 5, or their equivalents, are required for admission to the higher courses in Geology (8, 9, 16, 10, 14, 18).

The laboratory exercises in this course are designed to illustrate by means of specimens, models, photographs, stereopticon views, maps, and sections, the principal original and secondary structures of rocks; the origin and mode of occurrence of rocks in the earth's crust, their cycles of alteration and change; their interpretation and representation in geological surveys.

The field excursions comprise a series of observations upon the weathering of rocks; sea-shore phenomena, including beaches, cliffs, marine marshes; glacial phenomena, including glacial erosion, moraines, drumlins, glacial sand-plains, eskers, kames; igneous rocks, including dikes, sills, ancient lava-flows, local or contact metamorphism and the genesis of new minerals; stratified rocks, including simple and compound conglomerates, sandstones, slates; faulted igneous and sedimentary rocks; folds; joints, cleavage, schistosity, etc. Opportunity will be given for practice in constructing maps and sections, measuring the thickness of strata, and determining the relative age of geological structures.

GEOLOGY 8. — General Critical Geology. — Lectures, field-work, reports, and reading. Mr. J. B. WOODWORTH, assisted by Mr. WOODMAN.

Course 8 is open to those students only who have attained satisfactory grades in Courses 4 and 5, or their equivalents. Students taking this course must keep Thursday or Friday afternoon free for field work.

The lectures treat of the principles of classification of geological phenomena, the geological processes, their products and criteria; the nature of the forces involved therein; volcanic phenomena; movements of solid masses; the action of water, ice, wind, and life; geological history, including the physical changes, rocks, life, and climate of the principal periods, with reference to evolutionary hypotheses, time ratios, continuity of geological processes, etc. Lantern slides are frequently used in illustration of the lectures.

The field work consists of half-day excursions to localities in the neighborhood of Cambridge, illustrating problems in Structural and Physical Geology.

The class is divided into sections for library work and consultation. Geikie's *Text-book of Geology*, 3d ed., 1893, is required for collateral reading. The results of winter reading are to be presented in the form of reports and a bibliography of some subject germane to the course.

GEOLOGY 10. — Mining Geology. — The origin and geological relations of ore deposits. — Lectures, reading, and occasional field-work. Asst. Professor SMYTH.

Course 4 and Mineralogy 2, or their equivalents, are required as a preparation for this course.

This course is designed to give a broad and comprehensive account of the manner of occurrence of the ores of the more important metals. The course is divided into two parts. The first part deals with ore-deposits in their general mineralogical and geological relations, including their mineralogical and structural characters, the sources from which they have been derived and the processes by which they have been formed. In the second part of the course the more important sources of the world's supply of each metal are studied in detail. Special attention is given to the ores of iron, copper, gold, silver, lead, zinc, tin, nickel and manganese.

GEOLOGY 14. — General Palaeontology. — Lectures and theses. Professor SHALER and Dr. JACKSON.

This course is open to those only who have taken Geology 4 and 5, or who have an equivalent preparation. The ability to read scientific French and German is desirable.

The course is intended to give an acquaintance with the geological history of the various organic series, from the point of view of the student of organic life in general rather than in the way required by the practical geologist. Special attention is devoted to the theories concerning the origin and development of animals as far as these questions are brought into view in the palaeontological record. The course varies from year to year, but the the following synopsis will indicate the subjects generally treated. Conditions of organic life; heat, moisture, etc.; laws of the distribution of life on land and sea; conditions of fossilization; metamorphism and the preservation of the geological record; climatal and other evidence afforded by fossils. General history of the great divisions of the animal kingdom; the development of the motor system in animals; development of the skeletal, nervous, visual, reproductive, and other systems of the divisions; theories concerning the appearance and disappearance of animals as shown by fossils; palaeontological history of man.

GEOLOGY 15. — Historical Geology. — Laboratory and field-work, with conferences and theses. Professor SHALER and Dr. JACKSON.

This course is open to those only who have some knowledge of Geology and Palaeontology. Geology 8, 14, 14*a*, and S 2, and Zoölogy 2 afford a suitable preparation.

The course is designed particularly for those who intend making a specialty in Geology; its aim is to teach the use of fossils in identifying geological horizons, especially in the North American series of rocks Students who take this course will be expected to spend some weeks in field work in the eastern part of the United States.

GEOLOGY 18. — Economic Geology. — Non-metalliferous products and water-supply. — Lectures, reading, and theses. Professor SHALER and Asst. Professor SMYTH.

Course 18 is open to those only who have taken Courses 4 and 5, or Course S1, and Mineralogy 2. Course 8 and Mineralogy 12 are also desirable as a preparation.

GEOLOGY 22*a*. — Advanced Geological Field-Work. — Field and library work, with reports, conferences, and theses. Professors SHALER and WOLFF, Asst. Professor SMYTH, Dr. JAGGAR and Mr. J. B. WOODWORTH.

This course affords a training in the methods of original geological investigation in the field, the preparation of geological maps and reports, and experimental work in the laboratory. It is open to those only who have passed satisfactorily in Course 8, and who have studied Mineralogy. Additional experience in field work such as is acquired in Geology S 2, is desirable, as well as some knowledge of Petrography.

GEOLOGY 16. — Glacial Geology. — Lectures, conferences, and field-work. Mr. J. B. WOODWORTH.

Course 16 is open to those only who have taken Courses 4 and 5, or their equivalents. Courses *A*, 6, and 8 also are recommended. Students taking this course must keep one half-day in each week of the autumn free for field work.

This course treats of the geological work of ice, with particular reference to the Pleistocene Period; the glacial theory; the classification, distribution, the age of glacial deposits; their relations to other terrigenous deposits, and to the problems of archaeology, engineering, road-making, water-supply, mason's materials, etc. The field work affords practice in the determination and mapping of glacial deposits. A few winter excursions will be made to the coast and to other points where the effects of frost are to be observed.

The earlier excursions of this course will be conducted by the various instructors in selected localities, in order to give a systematic review of the geological phenomena of the neighborhood. Individual study of special areas will afterwards be undertaken.

Research in this course is conducted with a view to the publication of the results which may be obtained. During the fall and spring one full day's work each week in the field is required, occasionally under the guidance of the instructor. At the close of each field season, written reports with maps and sections are accepted as the student's record. During the winter the work consists of library research, geological modelling, drawing, map-making, and experimental or field work upon special problems.

Attendance upon the Geological Conference (see page 59) held on Tuesday evenings is expected of students in this course. Occasional reports, four or five times a year, before the Conference require some special preparation.

GEOLOGY 22*b*. — Geological Investigation in the Field and Laboratory, under the supervision of Professor SHALER and other teachers of the Department.

This course is intended for students who have already passed in Courses 22*a*, 10, 16, or 17, or their equivalents, and provides for systematic work leading to results worthy of publication.

The following special topics will, among others, be offered for study during the winter 1898–99: —

Geological Correlation, as illustrated by North American formations; intended especially for students pursuing Stratigraphical Geology. Mr. J. B. WOODWORTH.

Experimental Geology, for students who desire to extend the instruction of Courses 9 and 17 into original investigation. Dr. JAGGAR.

Attendance at the Geological Conference is expected of students taking this course.

GEOLOGY 27. — Pre-Cambrian Geology of North America: with especial reference to the stratigraphy and economics of the rocks in the original Laurentian area and the region of the Great Lakes. Asst. Professor SMYTH.

Geology 8 and Mineralogy 2 are required as a preparation for Geology 27; and Mineralogy 12 is recommended.

The object of this course is to give a systematic account of the present state of knowledge of the pre-Cambrian rocks of the North American continent. The principal subjects dealt with in the lectures are the lithological character of these rocks and their stratigraphical relations, so far as these have been determined, in the various regions in which they have been described; the historical development of opinion regarding their division into groups; and the time relations of these groups in separated areas.

Especial attention is devoted to the region of the Great Lakes, where, owing to relative simplicity of structure and a generally moderate degree of metamorphism, more definite progress towards a final solution of the problems of classification has been made than in any other area. During the course, the subjects of metamorphism, the development of secondary rock structures, and the principles of correlation applicable to non-fossiliferous formations, are considered in detail.

Geological Conference.

The instructors of the above-described courses meet their more advanced students in the Geological Laboratory at 7.45 on Tuesday evenings, for the presentation of reports on investigations, and for informal comment and discussion by those present. At each meeting there will be one or more leading papers on subjects announced in the weekly Calender, and discussion will be directed chiefly to the subjects thus presented. There will be also brief statements of the work in progress by instructors and students, and comments on new publications and other matters of interest.

GEOLOGICAL AND GEOGRAPHICAL EXCURSIONS.

A series of geological and geographical excursions to places within a day's travel will be conducted by the instructors of the Department during the autumn and spring. They will be open to all students of the University. By attending them in order, a general view of the geology and physical features of Southern New England may be obtained.

Excursions to more distant localities of interest are generally undertaken by the instructors in the April recess. Students who contemplate the professional study of Geology and Geography are invited to join these excursions, as they give opportunity for observation that cannot be secured during term-time.

GEOLOGY S 2. — Geological Field-Work.

An advanced course in Geological Field-Work: conducted in Cambridge, southern Massachusetts, Rhode Island, and Meriden, Conn., six times a week for six weeks. Professor SHALER and Dr. PALACHE.

GEOGRAPHY.

GEOGRAPHY *A*. — Elementary Physiography. — Lectures, written exercises, laboratory and field-work. Dr. DALY and Mr. BOUTWELL.

Course *A* is required for students who intend to take Courses 2, 6, 7, and 20; it is recommended to students expecting to take Course 8, in preparation for the more advanced courses in Geology.

The lectures consider the following subjects: The form and size of the earth. — Terrestrial magnetism. — The ocean: distribution of water, surface, area, depth, composition, form and deposits of the sea bottom, temperature, waves, currents, tides. — The land: continental form, plains, plateaus, rivers, lakes, mountains, volcanic forms, coasts, islands; considered in relation to geographical classification and evolution and to their effect on human development. Lantern illustrations will be frequently used. The laboratory work is directed to the study of charts and models of the ocean basins, charts of ocean temperature, currents, etc., models, diagrams, maps and views of various topographic types in different parts of the world.

GEOGRAPHY *B*. — Elementary Meteorology. — Lectures, written exercises, observations, and laboratory work. Mr. WARD.

Course *B* is required for admission to Courses 1, 19, 21, and 25.

The lectures present the subject under the following headings: The earth's atmosphere: its composition, temperature, pressure and general circulation. — The moisture of the atmosphere: dew, frost, clouds, rainfall. — Storms: cyclones, thunderstorms, tornadoes. — Weather. — Climate.

The laboratory work consists chiefly in the construction and study of weather maps and meteorological diagrams, practice in the use of ordinary meteorological instruments, individual record of observations, weather forecasting, etc.

GEOGRAPHY 6. — Physiography of the United States. — Lectures, library work, and reports. Professor DAVIS.

GEOGRAPHY 7. — Physiography of Europe. — Lectures, library work, and reports. Professor DAVIS.

Courses 6 and 7 are ordinarily given in alternate years. Course *A* or 2 is required, and Course 4 is recommended, in preparation for either; and in Course 7 some use of French and German books is desired.

In these courses, the subject will be treated on the plan developed in the elementary course (Geography *A*); the countries considered being divided first according to their geological structure, second according to their geographical development. The physical features of each area will be illustrated chiefly by maps of large scale, partly by photographs. Attention will be given to the relation of structure and form to conditions of human life, occupations, products, etc., in order that the course shall have value to the student of History and Economics, as well as to the student of Geography.

GEOGRAPHY 20. — Physiography (advanced course). — Conferences, reports, and theses. Professor DAVIS.

This course is open to those who have passed satisfactorily in Geography *A* and 6 or 7; ability to read German and French and a general understanding of Geology are desirable.

This course is designed to give opportunity for study supplementary to the more elementary courses in Physiography; it will consist of investigation of certain topics selected by the students with the advice of the instructor. Written reports on work accomplished are made by each student. Attendance on the Geological Conference (p. 159) is expected of students taking this course.

MINERALOGY.

MINERALOGY 2. — Mineralogy (including Crystallography, Physical and Chemical Mineralogy, and Descriptive Mineralogy). Professor WOLFF, Dr. PALACHE, and Dr. EAKLE.

Open to those only who take or have taken Chemistry 1. Students proposing to study Petrography are advised to take Course 8 with Course 2.

Text-books: G. H. Williams' *Elements of Crystallography*, and E. S. Dana's *Text-book of Mineralogy*.

The lectures are given at the hours mentioned in the programme. The amount of laboratory work necessary for the average student will be about six hours a week. The lectures first take up Crystallography, while the laboratory work is upon the collection of crystal models and natural crystals. An outline of Physical and especially of Optical Mineralogy is then given and illustrated in the lectures by experiments and demonstrations with the polariscope, which students can afterwards repeat in the laboratory. The larger part of the lectures and laboratory work is, however, devoted to systematic Descriptive and Determinative Mineralogy, which includes the chemical relations of the various species. The lectures are illustrated by specimens from the several collections, while in the laboratory, students are taught the various blow-pipe and other chemical tests, which they apply themselves on known and undetermined material. They follow the lectures with the minerals in the collection, and are then given drawers of unknown minerals to determine.

A student who has passed this course should have a knowledge of Mineralogy sufficient for all general purposes; he should be able to identify all but the rarer mineral species. If he wishes to pursue the subject further, he should take up special lines of study. The course is essential for all who wish to go on in Mineralogy or Geology, and is recommended

to all those who intend to be chemists. It affords training in observation and inductive reasoning for all engaged in the natural sciences. On this account it is also fitted to form part of a general education.

MINERALOGY 3. — Building Stones. Professor WOLFF.

A course of lectures, intended for architects and for those who specialize in Economic Geology.

The lectures will describe in an elementary way the mineral constituents and geological occurrence of the principal building stones. The description and classification of the building stones of the United States, quarry regions and methods of quarrying, use in cities, defects and action of the weather, methods of examination and testing will then be treated.

MINERALOGY 7. — Crystallography. — Practical exercises in the measurement, discussion, and drawing of crystals, with occasional lectures. Dr. PALACHE.

The work will consist in the measurement of crystals of the various systems on the reflecting goniometer, discussion of the results, and calculation and drawing of the forms, with occasional lectures on the use of the instruments and on methods of calculation and projection.

This course is open to those only who take or have taken Course 2.

MINERALOGY 8. — Physical Crystallography, mainly Optical Mineralogy and its applications. — Lectures and laboratory work. Professor WOLFF and Dr. PALACHE.

The lectures will deal mainly with crystal optics, with some attention to other topics in Physical Crystallography. The later lectures will be devoted to the applications of Optical Mineralogy in the study of minerals in Mineralogy and Petrography. The lectures will be illustrated by the polariscope and other demonstrations. The laboratory work will consist in the determination of the indices of refraction and other optical constants of minerals of the several systems, partly by means of preparations which the students will make themselves, and in a certain amount of practical study of the other subjects in Physical Crystallography which are covered by the lectures. The laboratory work of Courses 7 and 8 is carried on in the advanced mineralogical laboratory. The courses are open to those only who take or have taken Mineralogy 2. Course 7 is especially useful to chemists, and Course 8 to petrographers; while both courses are essential to those who wish to go further in Mineralogy.

MINERALOGY 12. — Petrography. — Lectures, laboratory work, and theses. Professor WOLFF and Dr. EAKLE.

Course 12 is open to those only who have taken Geology 4 and 5, or Geology S 1, and Mineralogy 2. Course 8 is also recommended.

The lectures treat of the structure, composition, classification, origin, geographical distribution, and geological occurrence of the various families of rocks and of the problems of Lithological Geology. The microscopical characters of the rock-forming minerals and the various methods of petrographical investigation in the field and laboratory are included in the course. The work in the petrographical laboratory supplements the lectures and enables students to become familiar with rocks and with practical methods of investigation, and their application to Geology.

MINERALOGY 20. — Mineralogical and Petrographical Research. Professor WOLFF and Dr. PALACHE.

Every facility will be given to students fitted for research in Mineralogy who wish to pursue the subject. A collection of minerals for scientific use is now in process of formation and will be extended in special lines as the need arises. Students taking mineralogical research should have passed in Mineralogy 2, 7, 8, and 12, Chemistry 1, 3, 4, 9, and Geology 4 and 5. This course should be taken only if the student is able to devote at least half of his time to it; to get the full advantage of it he should devote all his time to it. The work will consist in establishing new mineral species or the revision of old ones; in the study of the relation of the physical properties to chemical composition, or in the critical examination of some of the fuller suites of species contained in the collections.

Corresponding facilities for petrographical research are offered to students with a knowledge of general petrography such as is obtained from Course 12, in connection with the extensive laboratory and library resources of the Department and the varied field-problems of the region. The work is preferably based on material which the student has collected in the field in connection with the determination of field relations, utilizing the winter months for lithological study.

MINING AND METALLURGY.

MINING 1. — Prospecting and Exploring. Asst. Professor SMYTH.

This course must be preceded by Geology 10, or taken in the same year with it.

This course deals with the practical methods of geology which have for their object the discovery of mineral deposits, and the approximate determination of their extent and value. Especial attention is devoted to magnetic surveys with the dial-compass, dip-needle, and magnetometer, and their application to certain fields in the Eastern States and the Lake Superior region. Other subjects treated are test-pitting, drilling, panning, sampling, and rough methods of field-analysis.

The instruction is given by lectures, illustrated with maps, photographs, and specimens. During the term, an excursion will be made to localities in New England and New York, chiefly for the purpose of practice in the use of the magnetic instruments.

METALLURGY 2. — Metallurgy of iron and steel, copper and nickel. Lectures, reading, and excursions. Mr. FORSYTHE.

Chemistry 1, or its equivalent, is required as a preparation for this course.

The first part of the course will be devoted to the study of iron and steel. Under the subject of iron will be considered the methods of making pig- and wrought-iron, including a description of plants, a discussion of materials used and products obtained, and the uses to which the products are adapted.

Under steel, the methods of making various grades of steel will be considered, and the chemical and physical difference of the products will be discussed.

Under copper will be included a description of plants, and a discussion of the mechanical and chemical problems involved in the treatment of ores, smelting, and the refining of products. The discussion of nickel will follow similar lines.

Opportunities to visit metallurgical plants will be given at intervals during the term, and the Christmas recess will be devoted to a more extended excursion.

METALLURGY 3. — Metallurgy of lead, zinc, gold, silver, and the minor metals. — Lectures, reading, and excursions. Mr. FORSYTHE.

Chemistry 1, or its equivalent, is required as a preparation for this course.

Under lead will be included a discussion of the choice and preparation of materials, smelting by various methods, and the desilverization and refining of products.

Under gold and silver, the various details of amalgamation of free-milling and sulphide ores, and the successful leaching processes, will be considered.

The metallurgy of zinc will include a description of the methods of producing spelter and zinc-white, and a discussion of the phenomena accompanying the processes.

As much time as can be spared from the more important metals, will be devoted to the metallurgy of the minor metals.

An opportunity to visit metallurgical plants will be given during the April recess.

MINING 5. — Metal and Coal Mining. — Excavation, development, underground and surface transportation, drainage, ventilation, etc. — Lectures and reading. Asst. Professor SMYTH.

Engineering *5a* and Mining 1 are required as a preparation for this course.

This course is designed to give a systematic account of the operations incident to the development and working of coal-seams, and ore-bodies of various forms, sizes, attitudes and physical characters, under different conditions. The subjects treated are surface-excavation, hydraulic and open-pit mining, tunnelling, shaft-sinking, hand- and power-drilling, explosives, systems of mining, tramming and underground-haulage, hoisting, surface-handling, drainage, and ventilation.

The instruction is given by lectures supplemented by required reading in various text-books and in professional literature. The lectures are illustrated with maps and photographs. During the term short excursions will be made to mines in New England and the neighboring States.

METALLURGY 6. — Metallurgical Chemistry. — The analysis of ores, metals, slags, fuels, and refractory metals. — Fire-assaying. — Chiefly laboratory work. Mr. FORSYTHE.

Chemistry 4, or its equivalent, is required as a preparation for this course.

Text-books: Blair's *Chemical Analysis of Iron* and Furman's *Manual of Practical Assaying*.

This course will consist chiefly of laboratory work, with an occasional lecture. About ten hours a week in the laboratory will be necessary, in the case of average students, to complete the assigned work.

The subjects for analysis will be ores of iron, copper, nickel, lead, zinc, etc.; metallic products, such as pig-iron, steel, mattes, spelter, etc.; slags resulting from the heat-processes; fuels and fluxes, and refractory materials.

The fire-assaying will be restricted to ores carrying the precious metals.

The object of the course is to teach the student to work rapidly by using the various quick methods in present use, and by conducting several determinations at the same time.

HYGIENE.

HYGIENE 1. — The Elementary Physiology and Hygiene of Common Life. — Personal Hygiene. — Emergencies. Asst. Professor G. W. FITZ and Dr. BAILEY.

This is an introductory course intended to give the general knowledge of Human Anatomy, Physiology and Hygiene, which should be possessed

by every student; it is adapted not only for those who intend to study Medicine or Physical Training, but also for those who wish to obtain general information on the subject.

HYGIENE 2. — History of Physical Education. Asst. Professor G. W. FITZ.

This course is so arranged that the student becomes familiar with the literature of Physical Training and traces the contributions of different times and peoples to the subject. The history of the different sports is traced and the artistic records of the matter studied. The theories of Physical Training are studied comparatively as regards their anatomical and physiological relations, and are discussed in conferences.

HYGIENE 4. — Anthropomentry. — Measurements and Tests of the Body. — Effects of Age, Nurture, and Physical Training. — Lecture and Practical Exercises. Dr. D. A. SARGENT.

Systematic training is given in making measurements and tests of individuals for the purpose of determining their strength and deficiencies. Practice is also given in classifying measurements, forming typical groups and determining the relations of the individual to the group type. This course must be preceded by the course in General Anatomy at the Medical School or its equivalent.

HYGIENE 10. — General Hygiene. — Lectures, laboratory, excursions, and reports. Asst. Professor G. W. FITZ and Dr. BAILEY.

Course 10 is open to those only who have taken Chemistry 1 and 3, Botany 2, and Zoölogy 2. Zoölogy 3 is also recommended to students who intend to take this course.

SUMMER COURSES OF INSTRUCTION.

Among the courses of instruction to be offered by Harvard University in the summer of 1899, will be several that can be counted, under the regulations of the Faculty of Arts and Sciences, towards the degree of S.B.

For the pamphlet describing the Summer School Courses apply to M. CHAMBERLAIN, 16 University Hall, Cambridge, Mass.

GENERAL ACCOUNT OF THE SCHOOL.

The Lawrence Scientific School, together with Harvard College and the Graduate School, is under the control of the Faculty of Arts and Sciences of Harvard University. The instruction in these departments is given by the same teachers, mostly in classes which may be attended by pupils from any one of these schools. The life of the students in all three departments is in common; they share alike in all the advantages which the academic department of the University can afford them. So far as their plans may make it desirable, they are allowed without additional charge to attend lectures in the professional schools of the University.

The essential peculiarity of the Scientific School, as compared with the other schools which are managed by the Faculty of Arts and Sciences, is that the instruction which it provides for its students is arranged in groups of definite required courses, each of which is intended to afford in a four years' course of study the training necessary for one of the scientific professions, such as Engineering, Chemistry, Geology, etc. While with the consent of the Administrative Board of the School slight changes may be made in the prescribed studies in order to meet the particular needs of the individual student, the plan of these courses leading to the degree of Bachelor of Science must in general be adhered to. Students are, however, permitted, without additional charge, to attend any other instruction in addition to their required work which they may be fitted to pursue, except the exercises in special laboratories.

The School is a constituent part of Harvard University, and as such has the general advantages afforded by that institution. It is situated in Cambridge, a city of about eighty thousand inhabitants, at a distance of three miles from Boston, Mass. The city of Cambridge occupies a wholesome territory, and its sanitary state is good; it has been remarkably exempt from contagious diseases; during the several epidemics of cholera which have effected this country, the malady has appeared in but one household. In the United States census of 1880, Cambridge held the first place as regards healthfulness in the list of forty-three cities. The College buildings, including the dormitories, are subject to a careful sanitary inspection.

Students attending the School may lodge in the dormitories or in private houses, a list of which will be sent on application to the Secretary. They may take their meals in Memorial Hall, which affords accommodation for about 1100 persons; in the Foxcroft Club, which provides for about 300, or in private boarding houses.

Each student in the Scientific School has one of its officers designated as his Adviser, to whom he is to look for counsel concerning the conduct of his studies and for such other assistance as he may need during his residence at the University.

DEGREES.

THE DEGREE OF BACHELOR OF SCIENCE. — The degree of BACHELOR OF SCIENCE will be conferred upon any student who has fulfilled the requirements in any of the courses of study as laid down in the schedule. The grades of the degree with distinction of Bachelor of Science are *cum laude*, *magna cum laude*, and *summa cum laude*.

The grade of the degree and the course of study for which the degree is given will be specified in the Diploma.

DEGREES OF BACHELOR OF ARTS AND BACHELOR OF SCIENCE. — Students who wish to take the degree of S.B. in addition to the degree of A.B. may register in the Lawrence Scientific School after their third year in Harvard College (or after the satisfactory completion of fourteen courses counting toward the degree of A.B.). They may obtain the degree of A.B. on the satisfactory completion of the required number of courses counting toward that degree, and the degree of S.B. after at least two years in the Scientific School, the last year to be devoted to work prescribed by the Administrative Board of the Scientific School.

It is desirable that students who contemplate taking their degrees in this way seek advice in the selection of their studies while registered in the College, in order that they may enter the Scientific School fully prepared for the required work.

THE DEGREE OF DOCTOR OF SCIENCE. — The requisitions for the degree of DOCTOR OF SCIENCE are stated on p. 439 of the *University Catalogue*.

By recent action of the Governing Boards, the requirement of two years of residence at this University of a candidate for the Degree of Doctor of Science has been rescinded. The minimum requirement of residence is now *one year*, this period being fixed for all degrees by the Statutes. It is not the purpose of the change thus made to lower the standards for this degree; but only to reduce the amount of compulsory residence at this University. The Faculty will, in future, in estimating the amount of a candidate's study for the degree, give such weight as seems to them fitting, to advanced work done in the graduate department of another university.

HONORS.

Students in the Scientific School may be candidates for Honors at graduation on the same terms as students in Harvard College. See *University Catalogue*, 1898–99, p. 432.

REDUCTION OF THE COURSE TO THREE YEARS.

If a student has anticipated studies amounting to a substantial portion of the work of the First-Year, and desires to fulfil the requirements for the degree in three years, he may apply to the Administrative Board for leave so to do, specifying in his application the manner in which he proposes to arrange his studies for that purpose. The Administrative Board will decide on such applications according to the circumstances in each case.

INSTRUCTION IN OTHER DEPARTMENTS OF THE UNIVERSITY.

All students of the Scientific School may, if found competent, pursue any of the courses of instruction given in the other departments of the University, except exercises carried on in the special laboratories, without additional charge, but this provision does not apply to Special Students unless they pay the full tuition fee of $150.

SCHOLARSHIPS.

Sixteen University Scholarships, of the annual value of one hundred and fifty dollars each, have been established in the Scientific School.

There are also scholarships, not exceeding eight at any one time, of the annual value of one hundred and fifty dollars each, for the benefit of graduates of reputable Normal Schools in the United States.

Three Eveleth Scholarships of two hundred dollars each, and one Hilton Scholarship of two hundred and twenty-five dollars are available for students of the Scientific School; also one Jennings Scholarship of four hundred dollars — preference for the latter to be given to students of Mining Engineering.

These scholarships are assigned at the beginning of each academic year to meritorious students standing in need of such assistance.

Two thirds of the annual value of the scholarships are paid on February 21, and one third immediately after the issue of the June term-bill.

Applications for these scholarships must be filed with the Secretary of the School by the 1st of June.

FELLOWSHIPS.

Graduates of the Scientific School may be appointed to the Parker Fellowships, the John Thornton Kirkland Fellowship, the Morgan Fellowships, and the John Tyndall Scholarship.

Students in the Scientific School may also be appointed to the Kirkland Fellowship and Tyndall Scholarship, and, if graduates of Harvard College, to any of the above Fellowships or to the Harris Fellowship. For full information, see *University Catalogue*, 1898–99. pp. 455 et seq.

PRIZES.

Students in the Lawrence Scientific School may compete for the Bowdoin, Dante, Sales, and Sumner Prizes, for full information in regard to which see *University Catalogue*, 1898–99, p. 447.

FEES, EXPENSES, AND BONDS.

Students are classified as Undergraduates and Special Students. The tuition fee of every Undergraduate for the academic year is $150.

The following table exhibits four scales of annual expenditure, — clothing, washing, and the expenses of the long vacation not being included: —

	Low.	Moderate.	Liberal.	Very liberal.
Tuition	$150	$150	$150	$150
Books and Stationery	25	35	45	61
Room	22	50	100	195
Furniture (annual average)	10	15	25	50
Board	114	152	152	304
Fuel and light	11	15	30	45
Societies and subscription to sports (annual average)			35	50
Servant				25
Sundries	40	55	85	150
Total	$372	$472	$622	$1030

A student who pays the full fee of $150, is entitled to all the general privileges of the University and he has the right to take any courses for which he is qualified, given under the authority of the Faculty of Arts and Sciences.

Every student who takes a laboratory course, must pay, in addition to his tuition fee, the special fees pertaining to his laboratory course or courses. For each laboratory course in Physics, the fee is $10, which covers all charges. For study in the Chemical and Mineralogical laboratories, there is a general fee, which varies from $5 to $36, according to the nature and amount of the work undertaken, and also an individual fee for the use of materials in special investigations and for breakage, and in payment of fines for violation of the laboratory regulations. For laboratory courses in Natural History and in Psychology, the fee is $5, which covers all charges. For instruction and the use of the work shops in the Rindge Manual Training School, the fee is $15.

Members of the School — both undergraduates and special students — must give bonds in the sum of $200, signed by two bondsmen, one of whom must be a citizen of the United States, for the payment of all dues to the University. Instead of filing a bond, any student who prefers may pay his fees in advance, and deposit with the Bursar such a sum of money as may be deemed sufficient to secure payment of all other dues to the University. Every student who lives in a College room or boards at Memorial Hall or the Foxcroft Club must file a bond for $400, or pay rent for the year in advance, and make a deposit with the Bursar as security for the payment of his board at the rate of $5 a week.

No officer or student of the University is accepted as a bondsman.

The term-bills are issued February 1, and one week before Commencement, and are to be paid respectively on or before February 21 and October 10; but the second bills of candidates for degrees must be paid at least one day before Commencement. The first bill will contain two thirds; and the second bill one third of the annual charges. When a student severs his connection with the School, his whole bill becomes payable at once.

The first third of the academic year begins with the academic year, and ends December 31. The second third begins January 1 and ends March 31. The last third begins April 1 and ends at Commencement.

A student who enters the School after the beginning of the academic year is charged for instruction from the beginning of the third in which he enters. One who withdraws during the year is charged only to the end of the third in which he leaves, if before that time he gives written notice of his withdrawal to the Dean of the School; otherwise he is charged to the end of the third in which such written notice is given.

Deduction from the full tuition-fee of $150 a year is made for properly notified absence, as follows: for absence for three consecutive months, $30; for absence during the whole year, not including the mid-year and final examinations, or either of them, $100. A student who claims a deduction, on the ground of absence, must present at the Bursar's office a certificate from the Secretary as to the fact and duration of his absence; and in order to obtain such a certificate, he must have given previous notice of his intended absence to the Secretary.

TUITION-FEES OF SPECIAL STUDENTS.

The tuition-fees of special students are: —

For any laboratory course, alone or with other courses, $150 a year.

For certain laboratory courses additional fees are required for materials, reagents, use and breakage of apparatus.

For any elective full-course, $45; for a half-course, $25 — a year.

In all other cases the fees will be computed at the rate of $15 for an hour a week of instruction during the academic year up to $150. But in no case shall the tuition-fee be less than $30 or more than $150.

Any student who attends a course of instruction for only a part of the year must pay the full year's fees for that course; except that a student who is liable for the fee of $150 a year is entitled to the same remission as undergraduates.

ROOMS AND BOARD.

A list of rooms available for students of the School, with their prices for the academic year, can be obtained during the summer, by application to the Secretary. College rooms can, in some cases, be obtained, at the beginning of the year.

Members of any Department of the University can board at cost by joining the Association which uses the great dining-hall of Memorial Hall. The cost of board to the members of this association is expected not to exceed $4.25 a week. The Hall opens on the last Wednesday in September.

The Foxcroft Club is a coöperative organization for reducing the expenses of students, having quarters adjoining the College Yard. Simple articles of food are furnished to order at cost, making it possible to board at the Club for from $2.50 to $3.00 a week. By using the Club's dining-room, members are enabled to lodge cheaply at a distance from the University or in suburban towns.

A committee of the Faculty and students have charge of some hundred sets of chamber and study furniture which are rented at extremely low rates.

The Harvard Coöperative Society is another organization for reducing expenses. At the store of the Society, clothing, books, stationery, wood, coal, etc., can be purchased at reduced prices.

PRICES OF COLLEGE ROOMS FOR 1899-1900.

In each case the price is for the whole room from the beginning of the Academic Year until the next Commencement, and includes the daily care of the room.

$30. College House, No. 35.

$40. Divinity Hall, Nos. 6, 10, Divinity House, No. 4.

$45. Divinity Hall, Nos. 4, 5, 9, 12.

$50. College House, Nos. 57 and 58; Divinity Hall, Nos. 2, 3, 11, 14.

$55. College House, No. 66; Divinity Hall, Nos. 1, 13; Divinity House No. 2.

$60. College House, Nos. 22, 44; Divinity Hall, Nos. 20, 24, 34 38, A; Divinity House, No. 5.

$65. Grays, Nos. 33, 35; College House, Nos. 46, 48, 50, 52, 54, 60, 62, 64; Divinity Hall, Nos. 18, 26, 28, 32, 40, 42; Divinity House, No. 1.

$70. College House, Nos. 3, 4, 6, 7, 8, 9, 10, 15, 16, 18, 19, 20, 25, 26, 27, 28, 30, 31, 32, 37, 38, 39, 40, 41, 42; Divinity Hall, Nos. 7, 8, 21, 22, 35, 36.

$75. Hollis and Stoughton, Nos. 1, 2, 3, 4, 18, 19, 20; Stoughton, No, 17; College House, Nos. 47, 49, 51, 53, 59, 61, 63, 69, 70; Divinity Hall, Nos. 16, 27, 30, 41; Divinity House, No. 3.

$80. Grays, No. 34; College House, Nos. 11, 33, 45, 55, 65, 67, 68; Divinity Hall, Nos. 15, 17, 19, 23, 25, 29, 31, 33, 37, 39.

$85. Grays, Nos. 13, 15, 49, 51; College House, Nos. 1, 2, 21, 23, 24, 43.

$90. Weld, Nos. 25, 26, 52, 53; Grays, Nos. 3, 17, 19, 37.

$95. Hollis and Stoughton, Nos. 13, 14, 16.

$100. Hollis and Stoughton, Nos. 5, 6, 8, 9, 10, 11, 12, 22, 23, 24, 26, 27, 28; Hollis, No. 21; Stoughton, No. 25; Holyoke, Nos. 39, 45; Foxcroft, No. 6; Walter Hastings, No. 61; Wadsworth, Nos. 9 and 10, 11 and 12.

$105. Hollis and Stoughton, Nos. 29, 32; Grays, No. 36.

$110. Grays, Nos. 14, 29, 31.

$115. Grays, Nos. 1, 11, 18, 25, 27, 39, 45; College House, No. 29.

$120. Weld, Nos. 24, 27, 51, 54; Grays, No. 21.

$125. Hollis, No. 17; Weld, Nos. 9, 36; Matthews, Nos. 27, 28, 57, 58; Holyoke, No. 28; Foxcroft, Nos. 1, 2, 5; Gannett, No. 7; Walter Hastings, Nos. 13, 22, 23, 32, 46, 59; Perkins, Nos. 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22; Conant, Nos. 18, 30, 42.

$130. Hollis and Stoughton, Nos. 30, 31; Thayer, Nos. 17, 18, 19, 20, 41, 42, 65, 66.

$135. Thayer, Nos. 23, 24, 47, 48; Grays, Nos. 16, 30, 50, 52.

$140. Grays, Nos. 2, 9, 26, 40, 47.

$145. Grays, No. 22.

$150. Hollis, Nos. 15, 25; Stoughton, No. 15; Holyoke, Nos. 2, 3, 6, 11, 17, 40, 44, 46; Foxcroft, Nos. 3, 7, 8; Gannett. No. 9; Walter Hastings, Nos. 45, 60; Perkins, Nos. 1, 2, 25, 26, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 62, 63, 64, 65, 66, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88.

$160. Thayer, Nos. 13, 14, 15, 16, 35, 36, 43, 44, 59, 60, 67, 68; Grays, No. 32; Matthews, Nos. 25, 26, 29, 30, 55, 56, 59, 60.

$165. Thayer, Nos. 1, 2, 3, 4, 63, 64; Grays, Nos. 4, 10, 12, 20, 28, 38, 46, 48; Matthews, No. 6.

$170. Thayer, Nos. 25, 26, 49, 50; Grays, Nos. 6, 8, 42, 44.

$175. Thayer, Nos. 45, 46; Holyoke, Nos. 12, 29, 34; Foxcroft, No. 4; Perkins, Nos. 23, 24, 45, 46, 67, 68.

$185. Weld, Nos. 3, 5, 13, 14, 19, 20, 30, 32, 40, 41, 46, 47.

$190. Thayer, Nos. 5, 6, 8, 9, 10, 11, 12, 37, 38, 39, 40, 57, 58, 61, 62; Weld, Nos. 8, 34; Matthews, Nos. 9, 15, 39, 45.

$200. Thayer, Nos. 21, 22, 31, 51, 52, 56; Holyoke, Nos. 18, 22, 23, 37, 41, 42, 43, 47, 48; Gannett, Nos. 3 and 4, 6; Conant, Nos. 3, 4, 5, 7, 8, 9, 10, 11, 12; Wadsworth, Nos. 1 and 2, 13,

$215. Matthews, Nos. 22, 52.

$220. Thayer, Nos. 33, 34; Weld, No. 1; Matthews, Nos. 3, 4, 33, 34.

$225. Thayer, Nos, 27, 28, 32, 55; Matthews, Nos. 10, 16, 46; Holyoke, Nos. 1, 26, 30, 31, 32, 35, 36, 50; Gannett, Nos. 1, 2; Walter Hastings, Nos. 20, 30, 42; Conant, Nos. 1, 2, 15, 16, 19, 20, 21, 22, 23, 24, 27, 28, 29, 31, 32, 33, 34, 35, 36, 39, 40, 41, 43, 44, 45, 46, 47, 48; Wadsworth, No. 5 and 6.

$240. Weld, Nos. 18, 21, 22, 23, 45, 48, 49, 50.

$245. Weld, Nos. 4, 12, 15, 39, 42; Matthews, Nos, 19, 20, 21, 49, 50, 51.

$250. Weld, Nos. 6, 31. 33; Matthews, No. 5; Holyoke, Nos. 4, 9, 10, 13, 14, 15, 20, 21, 24, 25, 38, 49; Gannett, Nos. 5, 8; Walter Hastings, Nos. 14, 16, 18, 24, 26, 28, 33, 36, 39, 47, 50, 53, 56; Conant, Nos. 13, 14, 25, 26, 37, 38; Wadsworth, Nos. 3 and 4, 7 and 8, 14.

$265. Matthews, Nos. 23, 24.

$270. Weld, Nos. 16, 17, 43, 44.

$275. Holworthy, Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24; Weld, Nos. 2, 10, 11, 28, 29, 37, 38; Matthews, Nos. 1, 2, 8, 13, 14, 31, 32, 35, 36, 37, 38, 43, 44; Holyoke, Nos. 8, 19.

$290. Matthews, Nos. 53, 54.

$300. Holyoke, Nos. 5, 16, 27; Walter Hastings, Nos. 12, 21, 35, 38, 41, 44.

$325. { Matthews, Nos. 11, 12, 17, 18, 41, 42, 47, 48; Walter Hastings, Nos. 3, 6, 9, 11, 15, 17, 19, 25, 27, 29, 31, 34, 37, 40, 43, 57, 58.
$350. Walter Hastings, Nos. 1, 2, 4, 5, 7, 8, 10, 48, 49, 51, 54, 55.

Divinity Hall and House.

Divinity Hall and Divinity House are reserved primarily for students of the Divinity School, and rooms in those buildings will not be assigned to other students until the Thursday on which the academic year begins. Applications by students not of the Divinity School for rooms that shall remain unlet on that date, may be filed with the Bursar during the summer, but such applications must be accompanied in all cases by a written statement from the Dean of the Divinity School that the applicant is approved by him. Applicants who are not known to the Dean should present letters of introduction to him.

CLUBS.

Important work is done by students in Clubs which exist in more or less close connection with the several Departments of study, and meet frequently. These organizations, concerning which detailed information is given in the Departmental Pamphlets or may be obtained from instructors, include the following: —

Sanskrit Conference: fortnightly in the second half-year.
Classical Club: fortnightly.
Modern Language Conference: fortnightly.
Deutscher Verein: fortnightly.
Cercle Francais: fortnightly.
Philosophical Conference: monthly.
Harvard Pedagogical Club: fortnightly.
Harvard Memorial Society.
Harvard Folk-Lore Society.
Harvard Physical Club: twice in three weeks.
Harvard Chemical Club: fortnightly.
Boylston Chemical Society: fortnightly.
Botanical Conference: fortnightly.
Botanical Club: fortnightly.
Zoölogical Club: weekly.
Harvard Natural History Society: bi-monthly.
Harvard Engineering Society: monthly.

To these are to be added the Semitic Conference, the Classical Seminary, the Mathematical Conference, the Physical Colloquium, and the Geological Conference (see Announcement), which have something of the character of clubs.

Besides the above named clubs, existing for purposes of special study and discussion, there are organized in the University many societies

having religious, ethical, political, literary, musical, and social objects. The GRADUATES' CLUB, maintained by students in the Graduate School, may be especially mentioned. Its circular may be obtained on application.

PUBLICATIONS.

Some Departments of study issue periodicals or yearly volumes, embodying the work of instructors and students at the University. Other Departments make regular contributions, under an official heading, to the proceedings of certain learned societies or to journals of literature and science, existing outside of the University. The publications of the first class and those of the second which are also issued directly by the Departments are the following; including a few which, although connected with studies cultivated by the Faculty of Arts and Sciences, are independent of that Faculty: —

HARVARD ORIENTAL SERIES (Indo-Iranian Department): Vols. I-III issued. Vols. IV and V in press.

HARVARD STUDIES IN CLASSICAL PHILOLOGY (yearly): Vols. I-VIII issued. Vols. IX and X in preparation.

STUDIES AND NOTES IN PHILOLOGY AND LITERATURE (Modern Language Departments): yearly. Vols. I-V issued. Vols. VI and VII in preparation.

HARVARD HISTORICAL STUDIES: published under the direction of the Department of History and Government, from the income of the Henry Warren Torrey Fund. Vols. I-VII issued.

QUARTERLY JOURNAL OF ECONOMICS: in its thirteenth year.

ANNALS OF THE OBSERVATORY OF HARVARD COLLEGE: thirty-six volumes issued.

CONTRIBUTIONS FROM THE CRYPTOGAMIC LABORATORY: forty numbers issued.

PUBLICATIONS OF THE MUSEUM OF COMPARATIVE ZOÖLOGY: — BULLETIN, thirty-two volumes issued; MEMOIRS BY PROFESSORS AND ASSISTANTS, twenty-two volumes issued.

CONTRIBUTIONS FROM THE ZOÖLOGICAL LABORATORY: eighty-six numbers issued. (Some of the contributions are also contained in the Museum Bulletin.)

PUBLICATIONS OF THE PEABODY MUSEUM OF AMERICAN ARCHAEOLOGY AND ETHNOLOGY: — ANNUAL REPORTS, thirty-one numbers issued; PAPERS, six numbers issued; MEMOIRS, five numbers issued.

The HARVARD GRADUATES' MAGAZINE, issued quarterly, and now in its seventh year, gives a record of the current life and work of the University, biographical and bibliographical data regarding Graduates, besides articles on other matters of general interest.

THE UNIVERSITY CHAPEL.

BOARD OF PREACHERS.

FRANCIS GREENWOOD PEABODY, D.D., *Plummer Professor of Christian Morals.*

GEORGE HARRIS, D.D.
HENRY VAN DYKE, DD., LL.D.
GEORGE HODGES, D.D.
WILLIAM DEWITT HYDE, D.D., LL.D.
WILLIAM H. P. FAUNCE, A.M., D.D.

} *Preachers to the University for the year* 1898–99.

There have also served on this Board since its foundation in 1886:—

EDWARD EVERETT HALE, D.D.
ALEXANDER MCKENZIE, D.D.
THEODORE C. WILLIAMS, S.T.B.
GEORGE A. GORDON, D.D.
PHILLIPS BROOKS, D.D.
WILLIAM LAWRENCE, D.D.
BROOKE HERFORD, D.D.
HENRY VAN DYKE, D.D.
LYMAN ABBOTT, D.D.
CHARLES CARROLL EVERETT, D.D.
WASHINGTON GLADDEN, D.D.
LEIGHTON PARKS, D.D.
J. ESTLIN CARPENTER, A.M.
E. WINCHESTER DONALD, D.D.
SAMUEL MCCHORD CROTHERS, A.B.
SIMON J. MCPHERSON, D.D.
JOHN H. VINCENT, D.D.
SAMUEL D. MCCONNELL, D.D.
PHILIP S. MOXOM, D.D.
WILLIAM WALLACE FENN, S.T.B.

On May 10, 1886, a vote was passed by the President and Fellows "That five preachers to the University be annually appointed by the President and Fellows, with the concurrence of the Board of Overseers, who, in conjunction with the Plummer Professor of Christian Morals, shall arrange and conduct the religious services of the University." The Board of Overseers concurred in this vote on May 12, 1886, and in 1892 it was incorporated in the Statutes of the University.

On June 14, 1886, on the unanimous recommendation of the Preachers and the Plummer Professor, the President and Fellows voted "That the statute numbered 15, concerning religious exercises, be amended by striking out the clause, "at which the attendance of the students is required"; and on June 16 the Board of Overseers concurred in this vote. Attendance at the religious services of the University was thus, by the advice of those who conduct these services, made wholly voluntary.

The services in the University Chapel are directed by the Board of Preachers as follows: Each conducts daily morning prayers for about three weeks in each half-year, and each preaches on four Sunday evenings. The Preacher conducting morning prayers is in attendance every morning during his term of duty at Wadsworth House 1, and is at the immediate service of any student who may desire to consult him. On Thursday afternoons from November till May, vesper services are held in the University Chapel. These services are brief, largely musical, and with an address from one of the Preachers. Services on Sunday evenings are conducted by preachers of various communions by invitation of the Board of Preachers. The following preachers thus conducted services during the year 1897–98:—

Rev. Charles Cuthbert Hall, D.D., of New York.
Rev. Charles H. Brent, of Boston.
Rev. Professor T. K. Cheyne, D.D., of Oxford, England.
Rev. Edward Everett Hale, D.D., of Boston.
Rev. President W. J. Tucker, D.D., of Dartmouth College.
Rev. M. D. Babcock, D.D., of Baltimore, Md.
Rev. Franklin Hamilton, of Newtonville.
Rev. Professor A. V. G. Allen, D.D., of Cambridge.
Rev. T. T. Munger, D.D., of New Haven, Conn.
Rev. Henry Van Dyke, D.D., of New York.
Rt. Rev. Henry C. Potter, D.D., of New York.
Rev. Professor Edward Hale, of Cambridge.

The Preachers are glad to have their attention called to any cases of special need where they may be useful, or to any better methods of serving the moral and religious interests of the University. General correspondence for the current academic year should be addressed to the Plummer Professor, though any Preacher will gladly consider such questions as may be more appropriately addressed to him.

In addition to the opportunities for worship in Appleton Chapel, seats are provided for students, at the expense of the College, in the churches of the different denominations in Cambridge. St. John's Memorial Chapel of the Episcopal Theological School having been erected for the especial accommodation of Harvard students is free to them.

THE UNIVERSITY LIBRARY.

COUNCIL.

CHARLES WILLIAM ELIOT, LL.D., *President.*
WILLIAM COOLIDGE LANE, A.B., *Librarian.*
CHARLES ELIOT NORTON, LL.D., *Professor of the History of Art, Emeritus.*
CHARLES FRANKLIN DUNBAR, LL.D., *Professor of Political Economy.*
CRAWFORD HOWELL TOY, LL.D., *Professor of Hebrew.*
GEORGE LINCOLN GOODALE, LL.D., *Professor of Botany.*
MORRIS HICKY MORGAN, LL.D., *Assistant Professor of Latin.*
GEORGE LYMAN KITTREDGE, A.B., *Professor of English.*

COLLEGE LIBRARY.

WILLIAM COOLIDGE LANE, A.B., LIBRARIAN, and *Keeper of the University Records.*
WILLIAM HOPKINS TILLINGHAST, A.B., *Assistant Librarian.*
THOMAS J KIERNAN, A.M., *Superintendent of Circulation.*
ALFRED CLAGHORN POTTER, A.B., *Ordering Department.*
FRANK CARNEY, *Shelf Department.*
NATHANIEL DANA CARLILE HODGES, A.B., *Shelf Department.*
WALTER BENJAMIN BRIGGS, *Superintendent of Reading Room.*
THOMAS FRANKLIN CURRIER, A.B., *Assistant in Catalogue Department.*

MALCOLM STORER, M.D., *Curator of Coins.*
JAMES ATKINS NOYES, PH.B., A.B., *Editor of the Quinquennial Catalogue.*
WILLIAM GARROTT BROWN, A.M., *Deputy Keeper of the University Records.*

The College Library in Gore Hall is for the use of the whole University. All students who have given bonds may take out books, three volumes at a time, and may keep them one month. Officers of the University have direct access to the shelves in all parts of the library, and students engaged in advanced work, upon recommendation by their instructors, are allowed

access to those parts of the collection with which they are occupied. All students have the direct use of about 19,000 volumes in the reading room and the adjoining rooms. Of these 3800 are bound periodicals, 3900, miscellaneous reference books, 3600, government documents, and about 8000 are books withdrawn from general circulation at the request of instructors and "reserved" on shelves in the reading room for use in connection with the courses of instruction. Students who leave Cambridge for an absence of more than one week must first return all borrowed books.

The College Library is open every week-day for the delivery of books, from 9 A.M. to 5.30 P.M., except Thanksgiving day, Christmas day, the Twenty-second of February, Patriots' day, Memorial day, and the Fourth of July. The Reading Room is open from 9 A.M. to 10 P.M. During the summer vacation the library closes at 5.30 P.M., on Saturday at 1 P.M. On Sundays during term time the Library is open, for readers only, from 1 to 5.30 P.M.

The College Library may be consulted by anyone, when properly introduced, whether connected with the University or not. The privilege of borrowing books is also granted, under special regulations, to persons not connected with the University. *Blanks for making applications for such use may be had of the Librarian.*

SPECIAL LIBRARIES.

In addition to the College Library in Gore Hall, the University Library embraces the libraries of the several departments of the University, which are classed as Departmental Libraries, and the libraries maintained in the various branches of study pursued under the direction of the Faculty of Arts and Sciences, which are known as Laboratory and Class-Room Libraries.

The Departmental Libraries are in charge of the Deans and Directors of the several departments, or of Librarians named in the lists of officers of the departments. The Laboratory and Class-Room Libraries, with the names of their librarians, are enumerated (with some of the Departmental Libraries) on pages 411, 412.

Persons entitled to use the College Library can have access to the Departmental Libraries by applying to the Superintendent of Circulation at Gore Hall; but such libraries are primarily for the special use of the schools and departments, and are placed in the buildings or rooms belonging to such schools and departments.

The several libraries now contain about the following numbers of bound volumes: —

Gore Hall	365,800
Lawrence Scientific School (Engineering Library)	5,100
Bussey Institution (Jamaica Plain)	3,700
Phillips Library (Observatory)	9,000
Botanic Garden (Herbarium Library)	7,400
Law School	44,400
Divinity School	28,700
Medical School (Boston)	2,200
Museum of Comparative Zoölogy	32,000
Peabody Museum	2,000
Arnold Arboretum	6,100
Seven laboratory and sixteen class-room libraries	18,300
	524,700

The collection of pamphlets and maps in the College Library is very large, and is estimated to be equal in number to the collection of bound volumes. The departmental libraries have also considerable numbers of pamphlet monographs on subjects connected with their specialties; and these are not included in the count of volumes. The College Library has also a collection of coins.

The catalogue of the Gore Hall Collection, including pamphlets, is on cards, accessible to the public, and consists of two parts, the one arranged by authors, the other by subjects. Printed strips of titles added to all the libraries are issued two or three times a week; and they are posted in Gore Hall and in the departmental libraries. These titles are also inserted in bound volumes of slips, kept in the Reading Room. A series of "Bibliographical Contributions," is in course of publication. Fifty-three of such publications have already been issued. More extensive bibliographical works constitute another series, "Special Publications," of which Scudder's "Catalogue of Scientific Serials" (1633–1876, 8vo, pp. 370) makes No. 1, published in 1879, and "An Index to the Subject Catalogue of Harvard College Library" makes No. 2, published in 1891. There has also been issued a Catalogue of the Gray Collection of Engravings (4to, 1869); this collection is in the Fogg Museum of Art.

The Librarian has the custody of the Archives of the University, as well as of the University Collection, which includes printed material of all sorts, illustrating the history of the College and University.

LABORATORIES.

THE CHEMICAL LABORATORY.

OFFICERS.

HENRY BARKER HILL, A.M., DIRECTOR, and *Professor of Chemistry.*
CHARLES LORING JACKSON, A.M., *Erving Professor of Chemistry.*
THEODORE WILLIAM RICHARDS, PH.D., *Assistant Professor of Chemistry.*
JOSEPH TORREY, JR., PH.D., *Instructor in Chemistry.*
OTIS FISHER BLACK, A.M., *Assistant in General Chemistry.*
ALVIN SAWYER WHEELER, A.M., *Assistant in Organic Chemistry.*
DANIEL FRANCIS CALHANE, A.M., *Assistant in Descriptive Chemistry.*
JOHN PERCIVAL SYLVESTER, A.M., *Instructor in Chemistry.*
GREGORY PAUL BAXTER, A.M., *Instructor in Chemistry.*
FRANK HENRY GAZZOLO, PH.G., A.M., *Assistant in Descriptive Chemistry.*
BENJAMIN SHORES MERIGOLD, A.M., *Assistant in Descriptive Chemistry.*
JOHN WINTHROP DOW, A.B., *Assistant in Qualitative Analysis.*
ROBERT WARREN FULLER, A.B., *Assistant in Descriptive Chemistry.*
GEORGE WILLIAM HEIMROD, A.B., *Assistant in Physical Chemistry.*
LAWRENCE JOSEPH HENDERSON, A.B., *Assistant in Descriptive Chemistry.*
CARL TROWBRIDGE ROBERTSON, A.B., *Assistant in Descriptive Chemistry.*
EDWARD MALLINCKRODT, JR., *Assistant in Qualitative Analysis.*
WALTER GUSTAVUS WAITT, *Assistant in Qualitative Analysis.*
SIMON EVERARD WILLIAMS, PH.G., *Assistant in Quantitative Analysis.*

The Division of Chemistry of the Faculty of Arts and Sciences occupies the whole of Boylston Hall.

Boylston Hall was erected in 1857 with a fund bequeathed by the late WARD NICHOLAS BOYLSTON, which was subsequently largely increased by subscription. The hall was enlarged by the addition of a third story in 1870, and the accommodations were still further extended in 1891 and 1895. Besides several private laboratories and preparation rooms, the building contains seven large laboratories for students. A room on the upper story with one hundred and ninety-six places is especially devoted to qualitative and descriptive work. A large laboratory at the west end is fitted with all the modern appliances for the study of organic chemistry. On the lower story a laboratory with forty-four places is

reserved wholly for quantitative work, and connected with it is a laboratory, with twelve desks, especially fitted up for advanced work in inorganic chemistry. On the same story is a room devoted to work in physical chemistry; and further a large laboratory with one hundred and twenty-eight places for the most elementary class. In the basement is a laboratory for work in descriptive chemistry with two hundred and thirty-two places. On the second story are three lecture-rooms, a reading-room, departmental library, and a chemical museum.

All the courses of instruction in Chemistry to students of Harvard College, of the Lawrence Scientific School, and of the Graduate School, are given in Boylston Hall. The laboratories are open to Special Students to follow any line of chemical investigation. The facilities for research are unusually great.

THE JEFFERSON PHYSICAL LABORATORY.

OFFICERS.

JOHN TROWBRIDGE, S.D., DIRECTOR, and *Rumford Professor and Lecturer on the Application of Science to the Useful Arts.*

EDWIN HERBERT HALL, PH.D., *Professor of Physics.*

BENJAMIN OSGOOD PEIRCE, PH.D., *Hollis Professor of Mathematics and Natural Philosophy.*

WALLACE CLEMENT SABINE, A.M., *Assistant Professor of Physics.*

WINTHROP EDWARDS FISKE, A.M., *Assistant.*

WILLIAM EDWARD MCELFRESH, A.M., *Assistant.*

WILLARD STREETER BASS, A.B., *Assistant.*

EDWIN HENRY COLPITTS, A.M., *Assistant.*

CHARLES HAMILTON AYRES, JR., *Assistant.*

GEORGE W. THOMPSON, *Mechanician.*

In 1881, THOMAS JEFFERSON COOLIDGE, of Boston, of the Class of 1850, Minister to France 1888–96, gave $115,000 to the College for a new Physical Laboratory, on condition that $75,000 should be raised by subscription and the income appropriated to its support. The building was finished in Oct., 1884, and is called the Jefferson Physical Laboratory. All the instruction in Physics, by recitations, lectures, and experimental work, to students of Harvard College, of the Lawrence Scientific

School, and of the Graduate School, is given in this building, which accommodates the various physical cabinets. The building is four stories high, if the basement is included. In the eastern wing the whole height is divided between a large lecture-room below, and the great laboratory above. In the central and western portions of the building are three recitation-rooms for sections of forty or less; but the principal part of the central and western portions is broken up into a large number of small rooms, where the professors, assistants, and advanced students can pursue their separate investigations, and be secured against intrusion, or any disturbance of their instruments. In the basement and first story, stone tables, each supported by its own column of masonry, and without contact with the floors, furnish firm support for these instruments. In the centre of the western wing a large rectangular tower stands on an independent foundation, and is isolated from the surrounding rooms. It is designed for investigations which demand extraordinary stability, or a great height: as in Foucault's pendulum-experiment. Small openings have been left in the brick partitions which divide the length of the building, by means of which a long path is available for such experiments as that on the velocity of light. In the western wing, iron nails and pipes which would disturb delicate experiments in magnetism, were excluded in the construction of the building. In the bottom of the tower is a small underground room which may be used for experiments requiring a constant temperature.

A room is devoted to the accurate measurement of electrical resistances and is provided with standard coils.

A comparator for the measurement and comparison of standards of length occupies a room in the basement of the Laboratory.

The photographic room adjoins a large space on the fourth floor, which contains the rooms especially arranged for spectrum analysis. There are four principal laboratory rooms. One of these is 40x60 feet and is devoted to elementary laboratory instruction. A time wire from the Observatory is led to this room. The laboratory for advanced instruction in electricity is in the basement and is provided with instruments of the latest type. A machine room is supplied with power from an electric motor. In this room is a milling machine, a large machine lathe, a smaller lathe, and other mechanical appliances for designing and making apparatus. The machine room is under the charge of a skilled mechanician. Power can also be obtained from a twenty-five-horse-power engine which is placed in a house outside of the Laboratory.

THE PSYCHOLOGICAL LABORATORY.

OFFICERS.

HUGO MÜNSTERBERG, PH.D., M.D., DIRECTOR, and *Professor of Psychology.*
ROBERT MACDOUGALL, PH.D., ASSISTANT, and *Instructor in Psychology.*
THOMAS HARVEY HAINES, A.M., *Assistant in Psychology.*

The Psychological Laboratory, founded in 1891, occupies the second floor of Dane Hall and consists of eleven rooms. One room is used as a lecture-room only, another as a reading-room; two are fitted up as dark rooms. The very complete collection of apparatus is adapted in the first place to the purposes of original research work in all fields of experimental psychology, especially to the study of the ideas, feelings, emotions, and volitions, and offers unusually great facilities for research. Secondly, it serves for training of beginners in experiment, especially by a full material for the study of sensations and reactions. Thirdly, its large demonstration apparatus furnishes ample material for the experimental illustration of the psychological lecture courses. The psychological apparatus is supplemented by material and instruments for the study of the physiological processes which accompany mental life, and by the technical outfit of a workshop.

For the NATURAL HISTORY LABORATORIES, see pages 188, 190, 191.
The MEDICAL and DENTAL SCHOOLS have their separate laboratories.

MUSEUMS.

The UNIVERSITY MUSEUM comprehends the Museum of Comparative Zoölogy, the Botanical Museum, the Mineralogical Museum, the Natural History Laboratories, and the Peabody Museum of American Archaeology and Ethnology. The Semitic Museum is for the present placed in the building of the Peabody Museum.

The entrance to the Museum of Comparative Zoölogy and the Peabody Museum is from Divinity Avenue. The Natural History Laboratories and the Botanical and Mineralogical Museums are entered from Oxford Street.

The Museum of Comparative Zoölogy consists of the North wing of the University quadrangle (60 x 200 feet). The Natural History Laboratories are in the N. W. corner piece of the same quadrangle (95 x 75 feet), and in the adjoining sections of the central part of the University Museum of the Oxford Street façade.

The Botanical Museum occupies the central section of the University Museum, together with one-third of the southern sections.

The Mineralogical Museum occupies the southern section of the Oxford Street façade (60 x 60 feet).

The S. W. corner piece will contain large Lecture Rooms and Laboratories for the Natural History Departments, and its Exhibition Rooms will connect the Oxford Street façade of the Museum with the Peabody Museum (see pp. 599–600), which, when completed, will form the South wing of the University Museum building.

THE MUSEUM OF COMPARATIVE ZOÖLOGY.

FACULTY.

CHARLES WILLIAM ELIOT, LL.D., PRESIDENT.
———— ————, DIRECTOR and CURATOR.
GEORGE LINCOLN GOODALE, M.D., LL.D. } *Committee on the*
HENRY PICKERING WALCOTT, A.B., M.D. } *Museum.*
ALEXANDER AGASSIZ, LL.D., *Secretary.*

OFFICERS.

———— ————, DIRECTOR and CURATOR.
NATHANIEL SOUTHGATE SHALER, S.D., *Professor of Geology.*
EDWARD LAURENS MARK, LL.D., *Hersey Professor of Anatomy.*
WILLIAM MORRIS DAVIS, M.E., *Professor of Physical Geography.*

Appointed by the Faculty of the Museum.

WILLIAM MCMICHAEL WOODWORTH, PH.D., *Assistant in charge.*
WALTER FAXON, S.D., *Assistant in charge of Mollusks and Crustacea.*
SAMUEL GARMAN, *Assistant in Herpetology and Ichthyology.*
WILLIAM BREWSTER, *Assistant in Ornithology and Mammalogy.*
ALPHEUS HYATT, S.B., *Assistant in Invertebrate Palaeontology.*
SAMUEL HENSHAW, *Assistant in Entomology.*
ALFRED GOLDSBOROUGH MAYER, PH.D., *Assistant in charge of Echinoderms, Polyps, etc.*
CHARLES ROCHESTER EASTMAN, PH.D., *Assistant in Vertebrate Palaeontology.*
FRANCES MARY SLACK, *Librarian.*
MAGNUS WESTERGREN, *Artist.*

Appointed by the Corporation.

ROBERT TRACY JACKSON, S.D., *Instructor in Palaeontology.*
GEORGE HOWARD PARKER, S.D., *Instructor in Zoölogy.*
CHARLES BENEDICT DAVENPORT, PH.D., *Instructor in Zoölogy.*
ROBERT DECOURCY WARD, A.M., *Instructor in Climatology.*
JAY BACKUS WOODWORTH, S.B., *Instructor in Geology.*
WILLIAM ERNEST CASTLE, PH.D., *Instructor in Anatomy and Embryology.*
THOMAS AUGUSTUS JAGGAR, JR., PH.D., *Instructor in Geology.*
STEPHEN RIGGS WILLIAMS, A.M., *Assistant in Zoölogy.*
ROBERT JAY FORSYTHE, A.M., *Instructor in Metallurgy.*
ROBERT WILLIAM HALL, A.M., *Assistant in Zoölogy.*
JOSEPH EDMUND WOODMAN, S.B., *Assistant in Geology.*
JOHN MASON BOUTWELL, A.B., *Assistant in Physiography.*
CHARLES WILLIAM PRENTISS, A.M., *Assistant in Zoölogy.*
HERBERT WILBUR RAND, A.B., C.E., *Assistant in Zoölogy.*
PETER FRANDSEN, A.B., *Assistant in Zoölogy.*

The Museum of Comparative Zoölogy was founded in 1859 by private subscription with the assistance of the State of Massachusetts. In 1876 the property in the hands of the Trustees was transferred to the President and Fellows of Harvard College.

The Museum is under the management of a Faculty, who nominate the Curator and the Sturgis-Hooper Professor, and appoint the Assistants.

The Curator is charged with the direction of the scientific and educational interests of the Museum, as well as of its relations to the public.

The Exhibition Rooms open to the public are the Synoptic Room, the rooms containing the systematic collections of Mammals, Birds, Reptiles, Fishes, Mollusks, Crustacea and Insects, Radiates, Sponges and Protozoa, also the rooms devoted to the faunal collections of Europe, of North and South America, the Indo-Asiatic, the African, the Australian Realms, and the Atlantic and Pacific Rooms and the Rooms devoted to the Quaternary, Tertiary and Mesozoic fossils. The collections, so far as arranged, are open to visitors every week-day, from 9 A.M. till 5 P.M., and on Sunday, from 1 P.M. till 5 P.M. Entrance on the south side of the North wing.

The publications of the Museum consist of an annual Report (1861–1898) of an octavo Bulletin (vols. i.–xxxii.) and of Memoirs in quarto (vols. i.–xxii.). The Bulletin and Memoirs are devoted to the publication of original work by the Professors and Assistants of the Museum, of investigations carried on by students and others in the different laboratories of Natural History, and of work by specialists based upon the Museum collections.

The Library of the Museum is on the second floor of the N. W. corner of the Museum. It is intended for the use of the Professors and students of the Natural History Departments. The Library contains over 23,000 volumes, exclusive of 2900 volumes of pamphlets, and of the Whitney Library containing about 5000 volumes and nearly 1500 pamphlets, making the total number of volumes 31,200 and about 1800 pamphlets not yet arranged. The reading room is open from 9 to 1 and from 2 to 5.

LABORATORIES OF ZOÖLOGY, PALAEONTOLOGY, ENTOMOLOGY, GEOLOGY, AND PHYSICAL GEOGRAPHY.

The courses of instruction in Geology, Physical Geography and Meteorology, Palaeontology, Zoölogy, Microscopical Anatomy, Embryology, Entomology, are given in the laboratories (entrance on Oxford Street) connected with the Museum.

Courses of Instruction in Geology, Geography, and Meteorology, numbered A, 6, 7, and 20, by Professor Davis, and Courses B, 19, and 25 by Mr. Ward, are given in the Geological lecture-room and in the Geographical laboratories. Courses 4 in Geology is given by Professor Shaler in the Fogg Art Museum, the number of students being too large to be accommodated in the Geological lecture-room of the Museum. Courses

14, 15, 17, 18, 22*a*, and 22*b*, by Professor Shaler, Dr. Jackson, and Dr. Jaggar, are given in the Geological and Palaeontological laboratories and lecture-rooms. Courses 5, 8 and 16 are given by Mr. J. B. Woodworth in the Geological lecture-room and laboratory. Courses in Zoölogy numbered 1, 2, 3, 4, 5, 9, 10, 11, 15, 16, 20*a*, by Professor Mark and Drs. Jackson, Davenport, and Parker, are given in the Zoölogical, Embryological, and Palaeontological Laboratories.

The Instructors and Assistants of the Museum also receive Special Students in their respective departments.

The income of the Humboldt Fund (about $400) is applied, with the advice of the Faculty of the Museum, towards the maintenance of one or more persons engaged in study at the Museum, or at the Wood's Hole Fish Commission Station.

Two of the tables of the U. S. Fish Commission at Wood's Hole are at the disposal of the Director of the Museum, to whom application should be made before the first of May. Candidates should specify their qualifications and the work they intend to carry out.

The VIRGINIA BARRET GIBBS SCHOLARSHIP, of the value of $250, is assigned annually with the approval of the Faculty of the Museum at the recommendation of the Professors of Zoölogy and of Comparative Anatomy in Harvard University "in supporting or assisting to support one or more students who may have shown decided talents in Zoölogy and preferably in the direction of Marine Zoölogy."

THE BOTANICAL MUSEUM.

OFFICERS.

GEORGE LINCOLN GOODALE, M.D., LL.D., *Fisher Professor of Natural History.*

WILLIAM GILSON FARLOW, M.D., LL.D., *Professor of Cryptogamic Botany.*

ROLAND THAXTER, PH.D., *Assistant Professor of Cryptogamic Botany.*

ARTHUR BLISS SEYMOUR, S.M., *Assistant in Cryptogamic Herbarium.*

ROBERT GREENLEAF LEAVITT, A.M., *Assistant in Botany.*

GEORGE RICHARD LYMAN, A.B., *Assistant in Cryptogamic Botany.*

GEORGE THOMAS MOORE, S.B., A.M. *Assistant in Cryptogamic Botany.*

EDGAR WILLIAM OLIVE, S.M., A.M., *Instructor in Botany.*

OAKES AMES, A.B., *Assistant in Botany.*

RUDOLPH BLASCHKA, *Artist-naturalist.*

The collections at present accessible to the public are on the third floor of the central section of the University Museum. They are designed to

illustrate the principal systematic, biological, and economic relations of plants. The large and increasing WARE COLLECTION of glass models of flowers, prepared by the artists Leopold and Rudolph Blaschka of Germany, occupies the large exhibition room. Contiguous rooms contain collections of Cryptogams and economic products.

LABORATORIES OF CRYPTOGAMIC AND PHANEROGAMIC BOTANY.

The Cryptogamic Laboratories occupy the whole of the fifth floor (60 x 120 feet). Here is also kept the extensive Herbarium of Algae, Fungi, and Lichens. (Not open to the public.)

The Laboratories of Phanerogamic Botany are on the second floor, and are supplemented by private workrooms in other parts of the botanical section. On the ground floor is stored for the present the large collection of Fossil plants, now in process of arrangement.

The N. C. NASH BOTANICAL LECTURE-ROOM, the gift of a graduate in memory of his father, is on the first floor of the Museum.

THE MINERALOGICAL MUSEUM.

OFFICERS.

JOHN ELIOT WOLFF, PH.D., CURATOR, and *Professor of Petrography and Mineralogy.*

CHARLES LORING JACKSON, A.M., *Erving Professor of Chemistry.*

ROBERT DECOURCY WARD, A.M., *Instructor in Climatology.*

CHARLES PALACHE, PH.D., *Instructor in Mineralogy and Petrography.*

ARTHUR STARR EAKLE, PH.D., *Assistant in Mineralogy and Petrography.*

The mineralogical section of the University Museum, built in 1890–91 with a fund of about $50,000, raised wholly by subscription, forms the southern end of the University Museum, so far as at present completed. Entrance is by the south door on Oxford Street.

The exhibition room and gallery occupy the third and fourth floors and are open to the public on Wednesday and Sunday afternoons, from 1 to 5, and Saturday from 9 to 5.

The main mineralogical collections of the University are deposited here; they contain on the ground floor and gallery, the large systematic collection with special features and collections, such as the J. Lawrence Smith collection of meteorites, the William Sturgis Bigelow agates, the Hamlin collection of tourmalines, and many unique specimens presented by James A. Garland and others.

MINERALOGICAL LABORATORIES.

The Laboratories of Mineralogy and Petrography occupy the second floor, first floor, and basement, and contain a laboratory for advanced crystallographic investigation and optical mineralogy on the second floor; the large lecture-room, general laboratory for elementary mineralogy and blow-pipe analysis, special laboratory and library on the first floor, and in the basement a chemical laboratory equipped for mineral and rock analysis.

The courses in mineralogy, crystallography, and petrography (Mineralogy 2, 3^1, 7^1, 8^2, 12, 20) are given in these laboratories, where the instructors also receive properly qualified students who wish to follow special lines of mineralogical investigation.

THE PEABODY MUSEUM
OF
AMERICAN ARCHAEOLOGY AND ETHNOLOGY.

FACULTY.

CHARLES WILLIAM ELIOT, LL.D., PRESIDENT.
FREDERIC WARD PUTNAM, A.M., S.D., CURATOR, *Secretary*, and *Peabody Professor of American Archaeology and Ethnology.*
STEPHEN SALISBURY, A.M., LL.B.
CHARLES PICKERING BOWDITCH, A.M.
FRANCIS CABOT LOWELL, A.B.

OFFICERS.

FREDERIC WARD PUTNAM, A.M., S.D., CURATOR, and *Peabody Professor of American Archaeology and Ethnology.*

Appointed by the Faculty of the Museum.

CHARLES C. WILLOUGHBY, *Chief Assistant.*
ALICE C. FLETCHER, *Assistant* (Holder of the Thaw Fellowship).
ZELIA NUTTALL, *Honorary Assistant in Mexican Archaeology.*
JANE SMITH, *Assistant* and *Librarian.*
FRANCES H. MEAD, *Assistant* and *Secretary.*

Appointed by the Corporation.

FRANK RUSSELL, PH.D., *Instructor in Anthropology.*
ROLAND BURRAGE DIXON, A.B., *Assistant in Anthropology.*

The entrance to the Museum is on Divinity Avenue. The present building is one-half of the contemplated structure which will form the

southern wing of the University Museum. The Museum is in charge of the Curator and is open to the public, under proper restrictions, from 9 A.M. till 5 P.M. throughout the year, Sundays and holidays excepted. The arrangement of the collections is intended to facilitate research in General Anthropology with special reference to American and Comparative Archaeology and Ethnology. One of the galleries is temporarily occupied by the Semitic Museum of the University. The Mary Hemenway Collection of Archaeology and Ethnology of the southwestern tribes is arranged in the second gallery and in the large hall on the floor above. The collection obtained from the ancient ruins of Copan, by the special expeditions of the Museum, is arranged in the large hall on the third floor. The crowded condition of the hall will not permit its being opened to the public, but visitors will be admitted by applying at the office. The Anthropological Library, containing 1,948 volumes and 2,583 pamphlets, is open to members of the University. The publications of the Museum consist of Annual Reports, Special Papers and Memoirs.

In the Laboratories of the Museum, instruction is given in General Anthropology; and research courses, in American Archaeology and Ethnology and Somatology (see p. 386,) are open to students in the Graduate School and to undergraduates by special permission.

The Serpent Mound Park in Adams County, Ohio, containing the great Serpent Mound, is the property of the Peabody Museum. The park has been laid out as an appropriate surrounding to the important prehistoric monument it contains, and is free to the public under proper restrictions.

In addition to scholarships and fellowships annually awarded to Graduate Students, on nomination by the Faculty of Arts and Sciences, some of which may be given to properly qualified students of American Archaeology and Ethnology, the following are available only for students of that subject, and are awarded on nomination by the Faculty of the Peabody Museum: — namely, the HEMENWAY FELLOWSHIP, the THAW FELLOWSHIP, and the ROBERT C. WINTHROP SCHOLARSHIP. For details concerning these appointments, see pages 465, 467, and 483.

THE SEMITIC MUSEUM.

CURATOR.

DAVID GORDON LYON, PH.D., *Hollis Professor of Divinity.*

The Semitic Museum was founded in 1889 by JACOB H. SCHIFF, Esq., and was opened on May 13, 1891. It occupies temporarily a gallery in the new section of the Peabody Museum building, and is open to students and the public daily, except Sundays and holidays, from 9 A.M. till 5 P.M.

The object of the Museum is to gather such materials as shall illustrate the Semitic instruction given in the University, provide students and other specialists with the means of original research, and give to the general visitor as complete a view as possible of the products of Semitic art and archaeology.

The collection contains manuscripts, coins, photographs, Babylonian-Assyrian seals, cuneiform tablets of clay and stone, Phoenician glassware and a large number of casts of the finest of the Semitic monuments in the European museums. The objects are provided with descriptive labels. Beginning on the left of the door, the chronological order has been followed, where the size of the objects and the date of arrival have not hindered. The high cases in the room are largely filled with casts of Assyrian monuments, chiefly from the palaces of Assurnazirpal and Assurbanipal, ninth and seventh centuries B.C. The colored casts of monuments from the Babylonian ruin called Tello and from the ruins of the Persian Susa are among the finest in the collection. There are also casts of Hittite bas-reliefs and of Hittite and Persian inscriptions. There are twenty-five Mohammedan mortuary stones from Egypt with inscriptions in the Cufic character. A few of the manuscripts belonging to the museum, Syriac, Hebrew and Arabic, are exhibited in the railing case. The oldest is a Syriac manuscript of the Gospels written in 1207. Among the Hebrew manuscripts are a roll of the Law and rolls of the Prophets. Some of the latter are from Arabia and contain besides the Hebrew text a translation into Arabic written in Hebrew characters. In a case on the left of the door are the original Babylonian clay tablets, while one on the right contains the original stone seals and reproductions of many other small Assyrian and Babylonian objects. Of the many hundred photographs which the museum possesses, a few, chiefly representing Palestinian scenery, are on exhibition. In the room below is the cast of a winged lion, while in the basement are many cases of casts which, partly for lack of space, cannot yet be exhibited.

THE WILLIAM HAYES FOGG ART MUSEUM.

DIRECTOR.

CHARLES HERBERT MOORE, A.M., *Professor of Art.*

The WILLIAM HAYES FOGG ART MUSEUM was founded by Mrs. ELIZABETH FOGG of New York in memory of her husband, whose name it bears. Mrs. Fogg bequeathed to the President and Fellows for this purpose the sum of $220,000. Of this amount $150,000 was expended on the handsome fire-proof building which was completed in 1895 and is situated in the College Yard facing on Broadway. The building is of two stories with

a large lecture room, having a seating capacity of about five hundred, attached. On the ground floor is a large hall for casts with five smaller rooms for casts and other objects. The upper floor has a large gallery and four smaller rooms for the exhibition of works of art and for administration. The collections thus far consist of casts from important works in sculpture of the ancient, mediaeval, and Renaissance epochs, a classified collection of electrotypes from Greek and Roman coins, a small series of Greek vases, and a large and growing collection of photographs of works of art of all epochs and countries, including architecture, sculpture, and painting. These photographs are conveniently classified and catalogued; and are at all times accessible to members of the University and other visitors.

In the larger east room on the upper floor is deposited the GRAY COLLECTION OF ENGRAVINGS. This important and very valuable collection was bequeathed to Harvard College, with provision for its increase and maintainance, by the Hon. FRANCIS CALLEY GRAY, LL.D., of the Class of 1809. It was first deposited in Gore Hall under the care of Mr. Louis Thies, who prepared and published an elaborate Catalogue which forms a quarto volume of 530 pages. On the death of Mr. Thies, Dr. Ezra Abbott became its custodian; and later the Corporation appointed Mr. (now Professor) George H. Palmer its curator. On the completion of the building of the BOSTON MUSEUM OF FINE ARTS (the College having as yet no suitable place for its safe keeping and administration), it was loaned, for a term of seven years, to the Trustees of that institution and removed to Boston. Its first custodian in Boston was Mr. Erastus Brainerd, who was succeeded by Mr. E. H. Greenleaf. Later, it passed into the able curatorship of Mr. S. R. Koehler. The loan to the Trustees of the Boston Museum of Fine Arts was twice renewed, and in the autumn of 1897 the Corporation caused it to be returned to Cambridge and deposited in its present safe and convenient quarters under the care of the Director of the Museum — where it is always accessible to members of the University and to the public.

The Fogg Museum also contains the RANDALL COLLECTION OF ENGRAVINGS which was bequeathed to Harvard College by the late JOHN WITT RANDALL, A.M., M.D. of the Class of 1834. This collection contains about twenty thousand prints and drawings; and is accessible at all times under the rules and regulations which apply to the Gray Collection.

The Museum is open daily from 9 until 5 o'clock, and from 7 until 9 in the evening. On Sundays it is open from 1 until 5 in the afternoon.

In addition to the Museums above named, the University possesses Museums at the MEDICAL and DENTAL SCHOOLS and the SCHOOL OF VETERINARY MEDICINE.

BOTANIC GARDEN AND HERBARIUM.

THE BOTANIC GARDEN.

OFFICERS.

GEORGE LINCOLN GOODALE, M.D., LL.D., DIRECTOR, and *Fisher Professor of Natural History.*
OAKES AMES, A.B., *Assistant Director of the Botanic Garden.*
MERRITT L. FERNALD, S.B., *Nomenclator.*
ROBERT CAMERON, *Head Gardener.*

The BOTANIC GARDEN, founded in 1807, occupies about seven acres of land at the corner of Linnæan and Garden Streets, Cambridge. More than five thousand species of flowering plants are cultivated for educational and scientific purposes.

The range of greenhouses comprises eight divisions assigned respectively to: — (1) Succulents. (2) Australasian plants. (3) Mexican plants, and Ferns. (4) Palms and their allies. (5) Tropical orchids, aroids, etc. (6) Economic plants of hot climates. (7) Native plants forced into early blooming. (8) Plants grown for experimental use.

The space at the north-western part of the Garden is devoted to an exhibition of a large number of our North American species, with special reference to their morphology. The ground below the terrace is filled with illustrations of the Orders and principal Genera of the plants of the United States, together with species from the Old World for comparison.

The grounds and greenhouses are open to the public daily, from sunrise to sunset.

To students properly qualified, specimens of flowers and living plants are freely furnished, and facilities are offered in the laboratories in the Garden, for pursuing investigations in Morphology. Under certain restrictions, students are supplied with all necessary appliances for conducting experiments in Vegetable Physiology and its application to practical questions in horticulture.

From the first week in July until the second week in August, regular instruction in Botany is given at the Botanic Garden, in connection with the Summer School of the Faculty of Arts and Sciences (see pp. 390–394).

THE GRAY HERBARIUM.

OFFICERS.

BENJAMIN LINCOLN ROBINSON, PH.D., CURATOR.
CYRUS GUERNSEY PRINGLE, *Collector.*
MERRITT LYNDON FERNALD, S.B., *Assistant.*
JESSE MORE GREENMAN, S.B., *Assistant.*
MARY A. DAY, *Librarian.*

The GRAY HERBARIUM occupies a building in the Botanic Garden The collection, presented to Harvard University in 1864 by the late Professor ASA GRAY, now contains over three hundred thousand sheets of mounted specimens and is the result of more than sixty years of continuous growth. It embraces all orders of flowering plants, vascular cryptogams, and bryophytes, while the fungi, lichens, and algae have now been transferred to the Cryptogamic Herbarium in the Botanical Division of the University Museum. The Gray Herbarium is rich in type specimens of species and varieties, in standard and rare phaenogamic *exsiccati*, and in the possession of the greater part of the specimens which have been critically studied in the preparation the "Synoptical Flora of North America."

The bryophytes, chiefly represented by the extensive and valuable collections of Sullivant, James, and Taylor, are not accessible for general consultation. Other parts of the Herbarium may be consulted, under supervision of the staff, by advanced students and other properly qualified persons. Visiting specialists receive such facilities for work as can be given without interrupting the regular duties of the staff.

The Library of the Herbarium, now including more than twelve thousand carefully selected volumes and pamphlets, is open for consultation to all persons interested in Botany.

The scientific publications of the Herbarium at present embrace the following classes of work: I. The continuation of the "Synoptical Flora of North America." II. The issue from time to time of "Contributions from the Gray Herbarium of Harvard University," a series of technical papers devoted chiefly to the characterization of new species and monographing of genera. III. The preparation of lesser articles, both technical and popular, published in various scientific journals.

THE ASTRONOMICAL OBSERVATORY.

OFFICERS.

CHARLES WILLIAM ELIOT, LL.D., PRESIDENT.
EDWARD CHARLES PICKERING, LL.D., DIRECTOR, and *Paine Professor of Practical Astronomy.*
ARTHUR SEARLE, A.M., *Phillips Professor of Astronomy.*
SOLON IRVING BAILEY, A.M., *Associate Professor of Astronomy.*
WILLIAM HENRY PICKERING, S.B., *Assistant Professor of Astronomy.*
OLIVER CLINTON WENDELL, A.M., *Assistant Professor of Astronomy.*
JOHN RAYNER EDMANDS, S.B., *Assistant.*
ABBOTT LAWRENCE ROTCH, A.M., *Assistant in Meteorology.*
WILLIAMINA PATON FLEMING, *Curator of Astronomical Photographs.*
WILLARD PEABODY GERRISH, *Assistant.*
EDWARD SKINNER KING, A.M., *Assistant.*

The ASTRONOMICAL OBSERVATORY was established by means of a subscription initiated in 1843. The SEARS TOWER was completed in 1846; and the great refractor was received at the close of the same year. In 1848, EDWARD BROMFIELD PHILLIPS, of the Class of 1845, bequeathed to the University the sum of one hundred thousand dollars for the benefit of the Observatory. In 1885, ROBERT TREAT PAINE, of the Class of 1822, bequeathed his entire fortune, amounting to more than a quarter of million of dollars, to the University for the Observatory.

The Observatory was founded for the purpose of scientific research in all departments of Astronomy. To fulfil this purpose, it has been equipped with instruments of the first class and with a library of more than twenty thousand works (of which about half are pamphlets), principally relating to astronomical subjects. It has likewise been provided with funds for the maintenance and increase of its equipment and library, and for the payment of its current expenses, special provision having also been made for the publication of its observations.

One of the principal departments of the Observatory is the HENRY DRAPER MEMORIAL, maintained by Mrs. Draper to permit the study on a large scale of the spectra and other physical properties of the fixed stars.

The BOYDEN FUND furnishes the means of establishing an observing station at a considerable elevation, to avoid the serious difficulties in observation which arise from atmospheric causes. After preliminary experiments on mountains in Colorado and California, a station was established in the Andes, near Chosica, Peru, under the direction of Professor Bailey. This has been transferred to a site about 8000 feet high, near

Arequipa, Peru, where observations were conducted for two years under the direction of Professor W. H. Pickering. Professor Bailey has now returned to Peru and has taken charge of the station. He has recently established a series of meteorological stations crossing the Andes at the respective elevations of 100, 4,150, 8,060, 13,300, 15,600, 19,200, 11,000 and 3,000 feet.

In coöperation with the BLUE HILL METEOROLOGICAL OBSERVATORY, under the direction of Mr. Rotch, meteorological observations are maintained, and the results published in the Annals of the Observatory. The Blue Hill Observatory is situated upon land recently taken by the State as a public park, but a portion of this land has been leased to Harvard College, in order to ensure the continuance of the meteorological observations.

The Observatory is now provided with a photographic telescope of greater size than that of any similar instrument hitherto constructed. This telescope is the gift of Miss C. W. BRUCE, of New York. Its object-glass consists of four lenses, each 24 inches in aperture. The work for which it is specially designed is the production of stellar charts and photographs of stellar spectra. This instrument is now mounted at Arequipa, and is in use every clear evening.

By the mutual consent of astronomers, the Kiel and Harvard Observatories have been selected as the centres for the prompt announcement of astronomical discoveries. For example, when a comet is discovered in America its position is telegraphed to this Observatory, from here to Kiel, and thence to all the principal observatories of Europe.

Forty assistants take part in the work of the Observatory. The results obtained are published in a series of ANNALS, and now fill thirty-six quarto volumes. The preparation of these volumes occupies a large part of the force at the Observatory in Cambridge. Besides this labor, a large amount of observation is done there, several instruments being kept in constant use. The largest of these are the fifteen-inch and six-inch equatorial telescopes, the eight-inch transit circle, the eleven-inch Draper photographic telescope, the eight-inch photographic telescope, and the meridian photometer.

Instruction in Astronomy is not given at the Observatory, either by lectures or recitations. Facilities are freely offered to astronomers for making use of the library, buildings, grounds, instruments and photographs of the Observatory, so far as this can be done without interfering with regular work. Similar opportunities are sometimes offered to students specially devoting themselves to the study of Astronomy, but the constant employment of the principal instruments greatly limits the use that can be made of them for this purpose. Such students may apply for admission to the Director, with whom the fees for the privileges offered may be agreed upon. In some cases, a part or the whole of the fees may be remitted in consideration of services rendered in computation.

EXERCISE AND ATHLETIC SPORTS.

THE HEMENWAY GYMNASIUM.

OFFICERS.

DUDLEY ALLEN SARGENT, A.M., M.D., S.D., DIRECTOR.
JAMES GRAY LATHROP, *Instructor in Athletics.*
FRANCES DOHS, *Instructor in Gymnastics.*
CLARENCE BERTRAND VAN WYCK, *Recorder.*

This Gymnasium, named in honor of AUGUSTUS HEMENWAY, of Boston, of the Class of 1875, who gave it to the University, is a handsome and spacious structure, built in 1878 and equipped with the utmost thoroughness.

The growth of the University and the interest in this department during the past fifteen years has necessitated an increase of room and facilities which Mr. Hemenway has met by making an extensive addition to the Gymnasium in 1895.

This new addition affords an increased floor area of 15,000 square feet with locker, bathing, and dressing rooms, accommodating 2500 students.

An area of some 12,000 square feet of ground immediately connected with the Gymnasium has been enclosed, graded, and covered with asphalt, to afford facilities for practising gymnastic exercises and games in the open air.

The Gymnasium proper has a floor space of 30,000 square feet including a large main hall for general exercise, a running-gallery, rowing-room, and basement for Bowling Alleys, Hand Ball Courts, and rooms for Fencing, Sparring, Wrestling, and other exercises.

The Main Hall is furnished with a large variety of light and heavy gymnastic apparatus and all the best patterns of the modern developing appliances.

The building is lighted throughout by electricity and warmed and ventilated by a novel arrangement of steam pipes, light wells, and air shafts.

The Gymnasium is open to all members of the University free of expense, on week days from 11 A.M. to 1 P.M., 3 to 5.30, and 8 to 10 P.M., except on Saturdays, when it is closed at 7 o'clock.

The attendance is voluntary, and the system adopted is one designed to meet the special wants of each individual. Realizing the great diversity in age, size, and strength, as well as in health, of the students who attend the University, the Director makes no attempt to group them into classes pursuing the same course of exercises.

Upon entering the University, each student is entitled to an examination by the Director, in which his physical proportions are measured, his strength tested, his heart and lungs examined, and information solicited concerning his general health and inherited tendencies. From the data thus procured, a special order of appropriate exercises is made out for each student, with specifications of the movements and apparatus which he may best use. These exercises are marked in outline on cards without charge, or in handbooks accompanied by charts at a small expense. After working on this prescription for three or six months, the student is entitled to another examination, by which the results of his work are ascertained, and the Director enabled to make a further prescription. Students holding Scholarships are expected to be examined twice a year; and those desiring to enter Athletic Contests are required to be examined by the Director and to obtain his permission so to do.

In addition to the individual prescriptions, there are classes in Free Movements and Light Gymnastics designed to afford an opportunity for general development to all students of the University who are not members of the athletic teams or who are not in need of specially prescribed exercises.

All students of Harvard University desiring to enter as competitors in Athletic Contests are required to give evidence of their ability by making the following strength tests according to the Intercollegiate Agreement, in addition to the regular physical examinations: —

Candidates for the University Crew and Foot Ball Team and Weight Throwers are expected to make a total strength test of 700 points.

Candidates for the University Ball Nines and Track and Field Events, Class Crews and Foot Ball Teams and Gymnastic, Wrestling and Sparring Contests are expected to make a total strength test of 600 points.

Candidates for the University LaCrosse, Cricket, Tennis, and Golf Teams, Class Ball Nines, and Class Track and Field Events are expected to make a total strength test of 500 points.

These points are reckoned as follows: — The number of kilos. lifted with the back and legs straight, and the number of kilos. lifted with the legs bent, added to the strength of the grip of the right and left hand, expiratory power as tested by the manometer, and one-tenth of the weight in kilos. multiplied by the number of times that the person can raise his weight by dipping between the parallel bars and pulling his weight up to his chin on the horizontal bar. One twentieth of the lung capacity

may be substituted for the lung strength or expiratory test. Where the strength test falls below the desired standard the capacity of lungs is taken into account in summing up the condition.

These tests are made and certificates granted on any day, excepting Saturday and Sunday, between 2 and 4 P. M. within two weeks previous to a contest, but no examinations are made or certificates granted on the day of the contest.

COMMITTEE ON THE REGULATION OF ATHLETIC SPORTS.

FACULTY MEMBERS.

IRA NELSON HOLLIS, CHAIRMAN, *Professor of Engineering.*
EDWARD HICKLING BRADFORD, A.M., M.D., *Assistant Professor of Orthopedics.*
EDWIN HERBERT HALL, PH.D., *Professor of Physics.*

GRADUATE MEMBERS.

JAMES JACKSON STORROW, A.B.
AUGUSTUS PEABODY GARDNER, A.B.
BERTRAM GORDON WATERS, A.B.

UNDERGRADUATE MEMBERS.

JOHN WELLS FARLEY, *Graduate School.*
JOHN FORBES PERKINS, *Class of 1899.*
SAMUEL WATTS LEWIS, *Class of 1900*, SECRETARY.

SAMUEL LESTER FULLER, GRADUATE TREASURER.

The President and Fellows established the Committee on the Regulation of Athletic Sports by the following vote, to which the Overseers consented: —

"*Voted*, That the following be adopted as one of the standing rules and orders of the President and Fellows and the Board of Overseers: —

"A Committee for the Regulation of Athletic Sports shall hereafter be annually appointed and chosen as follows: three members of the University Faculties, and three graduates of the College — these six to be appointed by the Corporation with the consent of the Overseers; and also

three undergraduates to be chosen during the first week of the College year by the majority vote of the following students: the Presidents of the Senior, Junior and Sophomore classes, and a representative from each of the following athletic organizations: the Boat Club, the Cricket Club, and the Athletic, Base-ball, Foot ball, Cycling, and Tennis Associations, who shall be called together for the purpose of making this choice by the President of the University.

"This Committee shall have entire supervision and control of all athletic exercises within and without the precincts of the University, subject to the authority of the Faculty of Arts and Sciences, as defined by the Statutes."

Under the authority thus conferred the Committee exercises a general supervision over the grounds and buildings devoted by the University to athletic sports and exercise; over the times and places of athletic contests; and over the physical condition of those engaged in them. The regulations framed by the Committee forbid the employment of unauthorized persons as trainers, and require intercollegiate and other contests to be held at such times and places as will cause least interference with study. No person is permitted to take part in athletic contests without a physical examination by the Director of the Gymnasium, and his permission so to do. No person who is not a student of some department of the University in full and regular standing is allowed to take part in any athletic contest or exhibition. The Committee chooses its own officers, and appoints a Graduate Treasurer, who exercises supervision over the accounts of all athletic organizations using University grounds or buildings. The Committee makes a report annually to the President of the University.

BUILDINGS FOR ATHLETIC USES.

Besides the Gymnasium, four other buildings are held, either by the University or by trustees, for the exclusive use of students of the University.

A substantial building for the use of the Base-ball and other teams was erected in 1897–98 to the memory of Henry Astor Carey, Esq., in exchange for the building on Holmes Field surrendered to the University for purposes of instruction. It has a floor space of 7700 square feet.

The University Boat House, situated on Charles River, about half a mile from the College, is used principally by regular crews. It has a floor space of 6893 square feet.

By the gift of George Walker Weld, of the Class of 1860, a second boat house was erected in 1889–90 for the use chiefly of students not rowing

on regular crews. It is situated about one third of a mile from the College, and has lockers and boat-storage sufficient for the use of 300 students.

By subscriptions from Alumni the "Locker Building" was erected in 1893–94 on Soldier's Field. This building has a capacity of 1500 lockers, and contains also large shower-rooms and dressing-rooms.

PLAY-GROUNDS.

For out-door exercise, the University and the students themselves have provided three grounds. HOLMES FIELD, adjacent to the Gymnasium, is about 450 feet by 600 feet, and has an unencumbered area of about five acres.

JARVIS FIELD, a few hundred feet from Holmes Field, is about four acres in area, and is used exclusively by tennis-players.

By a gift made to the University in 1890 by HENRY LEE HIGGINSON, of the Class of 1855, the students are provided with an additional play-ground of twenty acres. This new field, named by the donor the SOLDIER'S FIELD, is situated in Allston, at a short distance across the Charles River, and is within easy reach of the College Yard. It is used for foot-ball and other sports. The students have erected upon this field permanent seats for fifteen thousand persons.

GENERAL SUMMARY.

Officers of Instruction and Administration.

CORPORATION		7
OVERSEERS		31
TEACHERS: —		
Professors	92	
Associate Professors	5	
Assistant Professors	37	
Lecturers	15	
Tutors	1	
Instructors	135	
Demonstrators and Assistants	126	
Whole number of Teachers		411
PREACHERS		5
CURATORS AND LIBRARY OFFICERS		18
PROCTORS AND OTHER OFFICERS		32

Students.

I. FACULTY OF ARTS AND SCIENCES: —			
1. COLLEGE: —			
Senior Class	369		
Junior Class	335		
Sophomore Class	508		
Freshman Class	471		
Special Students	168		
			1851
2. SCIENTIFIC SCHOOL: —			
Fourth-Year	51		
Third-Year	58		
Second-Year	96		
First-Year	153		
Special	67		
			425
3. GRADUATE SCHOOL: —			
Resident	308		
Non-Resident	14	322	
Whole No. of Students under Faculty of Arts and Sciences,			2598

II. Divinity School: —		
Resident Graduates	9	
Senior Class	2	
Middle Class	5	
Junior Class	8	
Special	2	
		26
III. Law School: —		
Resident Bachelors of Laws	1	
Third-Year	102	
Second-Year	170	
First-Year	220	
Special	58	
		551
IV. Medical School: —		
In Courses for Graduates	28	
Fourth Class	108	
Third Class	116	
Second Class	143	
First Class	165	
		560
V. Dental School: —		
Third-Year	46	
Second-Year	87	
First-Year	56	
		189
VI. School of Veterinary Medicine: —		
Third Class	7	
Second Class	9	
First Class	8	
Special	1	
		25
VII. Bussey Institution		23
		3922
Deduct for names inserted more than once		11
Total for the Academic Year 1898–99		3911
VIII. Summer School of 1898		759
Total, including Summer School		4670

SCHOOLS FROM WHICH STUDENTS HAVE ENTERED THE LAWRENCE SCIENTIFIC SCHOOL 1894–98 INCLUSIVE.

Adams Academy, Quincy, Mass.
Albany (N.Y.) State Normal College.
Albion College, Albion, Mich.
Allen Brothers' Private School, Newton, Mass.
Amherst College, Amherst, Mass.
Arkansas Industrial University, Fayetteville, Ark.
Arms Academy, Shelburne Falls, Mass.
Auburn (N.Y.) High School.

Baltimore (Md.) City College.
Barton Academy, Mobile, Ala.
Bath (Me.) High School.
Belmont (Cal.) School.
Belmont (Mass.) School.
Berkeley High School, New London, Conn.
Berkeley School, Boston, Mass.
Bethany College, Bethany, W. Va.
Blake's, W. S., Private School, New York, N.Y.
Boston (Mass.) College.
Boston (Mass.) English High School.
Boston (Mass.) Free Atelier.
Boston (Mass.) Latin School.
Boston (Mass.) University.
Bridgeport (Conn.) High School.
Brockton (Mass.) High School.
Bromfield School, Harvard, Mass.
Brookline (Mass.) Grammar School.
Brookline (Mass.) High School.
Brooklyn (N.Y.) Evening Schools.
Brooklyn (N.Y.) High School.
Brooklyn (N.Y.) Polytechnic School.
Brown University, Providence, R. I.
Browne & Nichols's School, Cambridge, Mass.
Browning's, J. A., Private School, New York, N.Y.
Bryant & Stratton's School, Boston, Mass.
Buffalo (N.Y.) High School.
Bussey Institution, Jamaica Plain, Mass.

Cambridge (Mass.) English High School.
Cambridge (Mass.) Latin School.
Cambridge (Mass.) Manual Training School.
Case School of Applied Science, Cleveland, O.
Charlestown (Mass.) High School.
Chauncy Hall School, Boston, Mass.
Chelsea (Mass.) High School.
Chem. Bact. Institute, Berlin, Germany.
Chenault's, D. A., School, Louisville, Ky.
Chicago (Ill.) Manual Training School.
Cleveland (Ohio) Central High School.
Coburn Classical Instisute, Waterville, Me.
Cohasset (Mass.) High School.
Colby Academy, New London, N. H.
Colby University, Waterville, Me.
College of the City of New York, N.Y.
Colorado School of Mines, Golden, Colo.
Columbia High School, So. Orange, N.J.
Columbia University, New York, N.Y.
Concord (Mass.) High School.
Concord (N. H.) High School.
Condon School, New York, N.Y.
Conn. Literary Institute, Duffield, Conn.
Cornell University, Ithaca, N.Y.
Cutler's, A. H., Private School, New York, N.Y.
Cutler's, E. H., School, Newton, Mass.

Dedham (Mass.) High School.
Deering (Me.) High School.
DeLancey School, Philadelphia, Pa.
De La Salle School, Chicago, Ill.
Denison (Texas) High School.
Denison University, Granville, Ohio.
DePauw University, Greencastle, Ind.
Detroit (Mich.) College of Law.
De Veaux School, Niagara Falls, N.Y.
Dickinson (Mass.) High School.
Drisler School, New York, N.Y.
Dubuque (Ia.) High School.
Durfee, H. M. C., High School, Fall River, Mass.

Eayr's, W. N., Private School, Boston, Mass.
Elmwood School, Buffalo, N.Y.

Fiske University, Nashville, Tenn.
Fitchburg (Mass.) High School.
Flexner's, Abraham, School, Louisville, Ky.
Florence (S. C.) Public Schools.
Flushing (N.Y.) High School.
Fordham (N.Y.) College.
Foxcroft (Me.) Academy.
Franklin (Ind.) College.
Friends' Academy, New Bedford, Mass.
Frye's, C. B., School, Boston, Mass.

Gardiner (Me.) High School.
Gloucester (Mass.) High School.
Grand Island (Neb.) High School.
Groton School, Groton, Mass.
Gunnery School, Washington, Conn.

Hale's, Albert, Private School, Boston, Mass.
Harvard College, Cambridge, Mass.
Harvard Graduate School, Cambridge, Mass.
Harvard Medical School, Boston, Mass.
Harvard School, Chicago, Ill.
Haverhill (Mass.) High School.
Haverhill (Mass.) Public School.
Heathcote School, Buffalo, N.Y.
Highgate School, England.
Hildreth's, Arthur, School, Boston, Mass.
Hill School, Pottstown, Pa.
Hingham (Mass.) High School.
Holderness School, Plymouth, N. H.
Hopkinson's, J. P., Private School, Boston, Mass.
Hyde Park (Mass.) High School.

Illinois State Normal University, Normal, Ill.
Indianapolis (Ind.) High School.
Ironton School, Ironton, Penn.

Jenner's, Wm., Private School, Syracuse, N.Y.

Keene, (N. H.) High School.
Keith's, M. S., Private School, Boston, Mass.
Kendall's, Joshua, Private School, Cambridge, Mass.
Kenwood School, Chicago, Ill.
King's School, Stamford, Conn.

Lake Forest (Ill.) Academy.
Lausanne (Switzerland) Public Schools.
Lawrenceville (N.J.) High School.
Lawrenceville School, Lawrenceville, N.J.
Lehigh University, So. Bethlehem, Pa.
Leland Stanford Jr. University, Stanford University, Cal.
Lincoln (Mass.) High School.
Louisville (Ky.) College of Pharmacy.
Louisville (Ky.) High School.
Lowell (Mass.) Commercial College.
Lowell (Mass.) High School.
Lynn (Mass.) Classical High School.
Lynn (Mass.) High School.

McGill University, Montreal, Canada.
Madison School, New York, N.Y.
Maine State College, Orono, Me.
Malden (Mass.) High School.
Mass. Agricultural College, Amherst, Mass.
Mass. Institute of Technology, Boston, Mass.
Medford (Mass.) High School.
Medway (Mass.) High School.
Melrose (Mass.) High School.
Michigan Agricultural College, Agri. Coll., Mich.
Michigan State Normal College, Ann Arbor, Mich.
Milton Academy, Milton, Mass.
Mohegan Lake School, Peekskill, N.Y.
Montclair (N.J.) High School.
Mosher's, C. E. E., Prep. School, New Bedford, Mass.
Mt. St. Mary's (Md.) College.

Nazareth Hall Military Academy, Nazareth, Pa.
New Albany (Ind.) High School.
New Bedford (Mass.) High School.
New York (N.Y.) College of Pharmacy.
Newark (N.J.) Techinal School.
Newburyport (Mass.) High School.
Newton (Mass.) High School.
Noble & Greenough's School, Boston, Mass.
Norristown (Pa.) Preparatory School.
Northern Ind. Normal School, Valparaiso, Ind.
Norwich (Conn.) Free Academy.

Oberlin College, Oberlin, O.
Olean (N.Y.) High School.
Owego (N.Y.) Free Academy.
Oxford (Me.) High School.

Peekskill (N.Y.) Military Academy,
Pennacook Normal School, Pennacook, N. H.
Penn. Military Academy, Chester, Pa.
Penn Yan Academy, Penn Yan, N.Y.
Perk Institute, Alleghany City, Pa.
Philadelphia (Pa.) College of Pharmacy.
Phillips Academy, Andover, Mass.
Phillips Academy, Exeter, N. H.
Phoenix (Ariz.) High School.
Pictou (N. S.) Academy.
Pittsburg (Pa.) Academy.
Pomfret School, Pomfret Center, Conn
Portland (Me.) High School.
Powder Point School, Duxbury, Mass.
Pratt Institute, Brooklyn, N.Y.
Prospect Union, Cambridge, Mass.
Providence (R. I.) High School.
Purdue University, Lafayette, Ind.

Quincy (Mass.) High School.

Racine College, Racine, Minn.
Reading (Mass.) High School.
Reading (Pa.) High School.
Red Hook (N.Y.) Public School.
Rensselaer Polytechnic Institute, Troy, N.Y.
Richmond (Ind.) High School.
Rideout's, Miss, Private School, Boston, Mass.
Ridge School, Washington, Conn.
Rockland (Mass.) High School.
Rogers High School, Newport, R. I.
Roxbury (Mass.) Drawing School.
Roxbury (Mass.) Latin School.
Rutgers Preparatory School, New Brunswick, N. J.

St. Joseph (Mich.) High School.
St. Louis (Mo.) High School.
St. Mark's School, Southborough, Mass.

St. Mary's College, Montreal, Can.
St. Paul's School, Concord, N. H.
St. Paul's School, Garden City, L. I.
Salem (Mass.) High School.
Sandwich (Mass.) High School.
School of Arts and Artisans, New York, N.Y.
Sedgwick Institute, Great Barrington, Mass.
Smith Academy, St. Louis, Mo.
Somerville (Mass.) High School.
Somerville (Mass.) Latin School.
Southbridge (Mass.) High School.
Springfield (Mass.) High School.
State Normal School, Bridgewater, Mass.
State Normal School, Bloomsbury, Pa.
State Normal School, California, Pa.
State Normal School, Columbus, O.
State Normal School, New Britain, Conn.
State Normal School, New Pultz, N.Y.
State Normal School, Oneonta, N.Y.
State Normal School, Terra Haute, Ind.
State Normal School, Westfield, Mass.
Stone's, C. W., School, Boston, Mass.
Stowell's, G. L., Private School, Lexington, Mass.

Taunton (Mass.) High School.
Thayer Academy, So. Braintree, Mass.
Torrington (Conn.) High School.
Tufts College, Tufts College, Mass.
Tulane University, New Orleans, La.

Union College, Schenectady, N.Y.
Université de France, Sorbonne, France.
University of Chicago, Chicago, Ill.
University of Cincinnati, Cincinnati, O.
University of Illinois, Urbana, Ill.
University of Kentucky, Lexington, Ky.
University of Michigan, Ann Arbor, Mich.
University of Minnesota, Minneapolis, Minn.
University of Nebraska, Lincoln, Neb.
University of North Carolina, Chapel Hill, N. C.
University of Ottawa, Ottawa, Can.
University of Pennsylvania, Philadelphia, Pa.
University of the South, Sewanee, Tenn.

University of Vermont, Burlington, Vt.
University of Toronto, Toronto, Can.
University of Wisconsin, Madison, Wis.
University School, Bridgeport, Conn.
University School, Chicago, Ill.
Uppingham School, England.
Urbana University, Urbana, O.

Vermont Academy, Saxton's River, Vt.
Volkmann School, Boston, Mass.

Waban School, Waban, Mass.
Wabash College, Crawfordsville, Ind.
Waltham (Mass.) High School.
Warner, B. & S., College, Providence, R. I.
Washington (D.C.) High School.
Washington University, St. Louis, Mo.
Watertown (Mass.) High School.
Wesleyan University, Delaware, O.
West Hartford (Conn.) High School.
W. Va. University, Morgantown, W. Va.
Westbrook Seminary, Westbrook, Mass.
Western High School, Washington, D. C.
Westminster School, New York, N.Y.
Weston (Mass.) High School.
William Jewell College, Liberty, Mo.
Williams College, Williamstown, Mass.
Williston Seminary, Easthampton, Mass.
Wilson & Kellogg's School, New York, N.Y.
Winchester (Mass.) High School.
Winthrop (Mass.) High School.
Woburn (Mass.) High School.
Woodbridge School, New York, N.Y.
Worcester (Mass.) Academy.
Worcester (Mass.) Classical High School.
Worcester (Mass.) English High School.
Worcester (Mass.) Polytechnic Institute.

Yale University, New Haven, Conn.

The Academic Year begins on the Thursday following the last Wednesday in September.

Commencement Day is on the last Wednesday in June.

The Vacation begins on the day after Commencement Day, and ends on the last Wednesday in September.

There are two short recesses, at Christmas and in April.

For copies of this Catalogue, Students' Expenses, etc., and for further information, address

MONTAGUE CHAMBERLAIN, Secretary, Cambridge, Mass.

☞ All official letters and all applications, addressed to the Administrative Board of the School, or to the Dean, should be sent to the Secretary's Office, 16 University Hall.

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BELOW.

CANCELLED

DEC 1 [redacted]

JAN [redacted]

CANCELLED

JAN 26 1974

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